

## **CHAPTER 33-10-04.1**

### **STANDARDS FOR PROTECTION AGAINST RADIATION**

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#### **33-10-04.1-01. Purpose.**

1. This chapter establishes standards for protection against ionizing radiation resulting from activities conducted pursuant to licenses or registrations issued by the department.
2. The requirements of this chapter are designed to control the receipt, possession, use, transfer, and disposal of sources of radiation by any licensee or registrant so the total dose to an individual, including doses resulting from all sources of radiation other than background radiation, does not exceed the standards for protection against radiation prescribed in this chapter. However, nothing in this chapter shall be construed as limiting actions that may be necessary to protect health and safety in an emergency.

**History:** Effective March 1, 1994; amended effective July 1, 1995.

**General Authority:** NDCC 23-20.1-04

**Law Implemented:** NDCC 23-20.1-03, 23-20.1-04

**33-10-04.1-02. Scope.** This chapter applies to persons licensed or registered by the department to receive, possess, use, transfer, or dispose of sources of radiation. The limits in this chapter do not apply to doses due to background radiation, to exposure of patients to radiation for the purpose

of medical diagnosis or therapy, to exposure from individuals administered radioactive material and released under section 33-10-07.1-32 or to exposure from voluntary participation in medical research programs.

**History:** Effective March 1, 1994; amended effective May 1, 1998; March 1, 2003.

**General Authority:** NDCC 23-20.1-04

**Law Implemented:** NDCC 23-20.1-03, 23-20.1-04

**33-10-04.1-03. Definitions.** As used in this chapter:

1. "Air-purifying respirator" means a respirator with an air-purifying filter, cartridge, or canister that removes specific air contaminants by passing ambient air through the air-purifying element.
2. "Annual limit on intake" (ALI) means the derived limit for the amount of radioactive material taken into the body of an adult worker by inhalation or ingestion in a year. Annual limit on intake is the smaller value of intake of a given radionuclide in a year by the reference man that would result in a committed effective dose equivalent of five-hundredths sievert [5 rem] or a committed dose equivalent of five-tenths sievert [50 rem] to any individual organ or tissue. Annual limit on intake values for intake by ingestion and by inhalation of selected radionuclides are given in table I, columns 1 and 2, of appendix B.
3. "Assigned protection factor (APF)" means the expected workplace level of respiratory protection that would be provided by a properly functioning respirator or a class of respirators to properly fitted and trained users. Operationally, the inhaled concentration can be estimated by dividing the ambient airborne concentration by the assigned protection factor.
4. "Atmosphere-supplying respirator" means a respirator that supplies the respirator user with breathing air from a source independent of the ambient atmosphere, and includes supplied-air respirators (SARs) and self-contained breathing apparatus (SCBA) units.
5. "Class" means a classification scheme for inhaled material according to its rate of clearance from the pulmonary region of the lung. Materials are classified as D, W, or Y, which applies to a range of clearance half-times: for class D, days, of less than ten days, for class W, weeks, from ten to one hundred days, and for class Y, years, of greater than one hundred days. "Lung class" and "inhalation class" are equivalent terms.
6. "Declared pregnant woman" means a woman who has voluntarily informed the licensee, in writing, of her pregnancy and the estimated date of conception. The declaration remains in effect until the declared pregnant woman withdraws the declaration in writing or is no longer pregnant.

7. "Demand respirator" means an atmosphere-supplying respirator that admits breathing air to the facepiece only when a negative pressure is created inside the facepiece by inhalation.
8. "Derived air concentration" (DAC) means the concentration of a given radionuclide in air which, if breathed by the reference man for a working year of two thousand hours under conditions of light work, results in an intake of one annual limit on intake. The condition of light work is an inhalation rate of 1.2 cubic meters of air per hour for two thousand hours in a year. Derived air concentration values are given in table I, column 3, of appendix B.
9. "Derived air concentration-hour" (DAC-hour) means the product of the concentration of radioactive material in air, expressed as a fraction or multiple of the derived air concentration for each radionuclide, and the time of exposure to that radionuclide, in hours. A licensee or registrant may take two thousand derived air concentration-hours to represent one annual limit on intake, equivalent to a committed effective dose equivalent of five-hundredths sievert [5 rem].
10. "Disposable respirator" means a respirator for which maintenance is not intended and that is designed to be discarded after excessive breathing resistance, sorbent exhaustion, physical damage, or end-of-service-life renders it unsuitable for use. Examples of this type of respirator are a disposable half-mask respirator or a disposable escape-only self-contained breathing apparatus (SCBA).
11. "Dosimetry processor" means an individual or an organization that processes and evaluates individual monitoring devices in order to determine the radiation dose delivered to the monitoring devices.
12. "Filtering facepiece (dust mask)" means a negative pressure particulate respirator with a filter as an integral part of the facepiece or with the entire facepiece composed of the filtering medium, not equipped with elastomeric sealing surfaces and adjustable straps.
13. "Fit factor" means a quantitative estimate of the fit of a particular respirator to a specific individual, and typically estimates the ratio of the concentration of a substance in ambient air to its concentration inside the respirator when worn.
14. "Fit test" means the use of a protocol to qualitatively or quantitatively evaluate the fit of a respirator on an individual.
15. "Helmet" means a rigid respiratory inlet covering that also provides head protection against impact and penetration.
16. "Hood" means a respiratory inlet covering that completely covers the head and neck and may also cover portions of the shoulders and torso.

17. "Inhalation class" [see "class"].
18. "Loose-fitting facepiece" means a respiratory inlet covering that is designed to form a partial seal with the face.
19. "Lung class" [see "class"].
20. "Negative pressure respirator (tight-fitting)" means a respirator in which the air pressure inside the facepiece is negative during inhalation with respect to the ambient air pressure outside the respirator.
21. "Nonstochastic effect" means a health effect, the severity of which varies with the dose and for which a threshold is believed to exist. Radiation-induced cataract formation is an example of a nonstochastic effect. "Deterministic effect" is an equivalent term.
22. "Planned special exposure" means an infrequent exposure to radiation, separate from and in addition to the annual occupational dose limits.
23. "Positive pressure respirator" means a respirator in which the pressure inside the respiratory inlet covering exceeds the ambient air pressure outside the respirator.
24. "Powered air-purifying respirator (PAPR)" means an air-purifying respirator that uses a blower to force the ambient air through air-purifying elements to the inlet covering.
25. "Pressure demand respirator" means a positive pressure atmosphere-supplying respirator that admits breathing air to the facepiece when the positive pressure is reduced inside the facepiece by inhalation.
26. "Qualitative fit test (QLFT)" means a pass or fail fit test to assess the adequacy of respirator fit that relies on the individual's response to the test agent.
27. "Quality factor (Q)" means the modifying factor listed in tables I and II of section 33-10-01.14 that is used to derive dose equivalent from absorbed dose.
28. "Quantitative fit test (QNFT)" means an assessment of the adequacy of respirator fit by numerically measuring the amount of leakage into the respirator.
29. "Quarter" means a period of time equal to one-fourth of the year observed by the licensee, approximately thirteen consecutive weeks, providing that the beginning of the first quarter in a year coincides with the starting date of the year and that no day is omitted or duplicated in consecutive quarters.

30. "Reference man" means a hypothetical aggregation of human physical and physiological characteristics determined by international consensus. These characteristics may be used by researchers and public health workers to standardize results of experiments and to relate biological insult to a common base. A description of the reference man is contained in the international commission on radiological protection report, ICRP Publication 23, "Report of the Task Group on Reference Man".
31. "Respiratory protection equipment" means an apparatus, such as a respirator, used to reduce an individual's intake of airborne radioactive materials.
32. "Sanitary sewerage" means a system of public sewers for carrying off wastewater and refuse, but excluding sewage treatment facilities, septic tanks, and leach fields owned or operated by the licensee or registrant.
33. "Self-contained breathing apparatus (SCBA)" means an atmosphere-supplying respirator for which the breathing air source is designed to be carried by the user.
34. "Stochastic effect" means a health effect that occurs randomly and for which the probability of the effect occurring, rather than its severity, is assumed to be a linear function of dose without threshold. Hereditary effects and cancer incidence are examples of stochastic effects. "Probabilistic effect" is an equivalent term.
35. "Supplied-air respirator (SAR) or airline respirator" means an atmosphere-supplying respirator for which the source of breathing air is not designed to be carried by the user.
36. "Tight-fitting facepiece" means a respiratory inlet covering that forms a complete seal with the face.
37. "User seal check (fit check)" means an action conducted by the respirator user to determine if the respirator is properly seated to the face. Examples include negative pressure check, positive pressure check, irritant smoke check, or isoamyl acetate check.
38. "Very high radiation area" means an area, accessible to individuals, in which radiation levels from radiation sources external to the body could result in an individual receiving an absorbed dose in excess of five gray [500 rad] in one hour at one meter from a source of radiation or from any surface that the radiation penetrates. At very high doses received at high dose rates, units of absorbed dose, gray and rad, are appropriate, rather than units of dose equivalent, sievert and rem.
39. "Weighting factor"  $w_T$  for an organ or tissue (T) means the proportion of the risk of stochastic effects resulting from irradiation of that organ

or tissue to the total risk of stochastic effects when the whole body is irradiated uniformly. For calculating the effective dose equivalent, the values of  $w_T$  are:

ORGAN DOSE WEIGHTING FACTORS	
Organ or Tissue	$w_T$
Gonads	0.25
Breast	0.15
Red bone marrow	0.12
Lung	0.12
Thyroid	0.03
Bone surfaces	0.03
Remainder	0.30 <sup>a</sup>
Whole body	1.00 <sup>b</sup>

<sup>a</sup> 0.30 results from 0.06 for each of five "remainder" organs, excluding the skin and the lens of the eye, that receive the highest doses.

<sup>b</sup> For the purpose of weighting the external whole body dose, for adding it to the internal dose, a single weighting factor,  $w_T = 1.0$ , has been specified. The use of other weighting factors for external exposure will be approved on a case-by-case basis until such time as specific guidance is issued.

**History:** Effective March 1, 1994; amended effective May 1, 1998; March 1, 2003.

**General Authority:** NDCC 23-20.1-04, 28-32-02

**Law Implemented:** NDCC 23-20.1-03

**33-10-04.1-04. Implementation.** This chapter became effective March 1, 1994, and all licensees and registrants must comply by that date except for the following:

1. Any existing license or registration condition that is in place prior to implementation of this chapter and is more restrictive than this chapter remains in force until there is an amendment or renewal of the license or registration.
2. If a license or registration condition exempts a licensee or registrant from a provision of this chapter in effect on or before March 1, 1994, it also exempts the licensee or registrant from the corresponding provision of this chapter.
3. If a license or registration condition cites provisions of this chapter in effect prior to March 1, 1994, which do not correspond to any provisions

of this chapter, the license or registration condition remains in force until there is an amendment or renewal of the license or registration that modifies or removes this condition.

**History:** Effective March 1, 1994; amended effective March 1, 2003.

**General Authority:** NDCC 23-20.1-04

**Law Implemented:** NDCC 23-20.1-03, 23-20.1-04

#### **33-10-04.1-05. Radiation protection programs.**

1. Each licensee or registrant shall develop, document, and implement a radiation protection program sufficient to ensure compliance with the provisions of this chapter. See subsection 2 of section 33-10-04.1-15 for recordkeeping requirements relating to these programs.
2. To the extent practical, the licensee or registrant shall use procedures and engineering controls based upon sound radiation protection principles to achieve occupational doses and public doses that are as low as is reasonably achievable (ALARA).
3. At intervals not to exceed twelve months, the licensee or registrant shall review the radiation protection program content and implementation.
4. To implement the as low as is reasonably achievable (ALARA) requirements of subsection 2, and notwithstanding the requirements of subsection 1 of section 33-10-04.1-07, a constraint on air emissions of radioactive material to the environment, excluding radon-222 and its daughters, shall be established by licensees, such that the individual member of the public likely to receive the highest dose will not be expected to receive a total effective dose equivalent in excess of one-tenth millisieverts [10 millirems] per year from these emissions. If a licensee subject to this requirement exceeds this dose constraint, the licensee shall report the exceedance as provided in subsection 3 of section 33-10-04.1-16 and promptly take appropriate corrective action to ensure against recurrence.

**History:** Effective March 1, 1994; amended effective May 1, 1998; March 1, 2003.

**General Authority:** NDCC 23-20.1-04

**Law Implemented:** NDCC 23-20.1-03, 23-20.1-04

#### **33-10-04.1-06. Occupational dose limits.**

1. **Occupational dose limits for adults.**
  - a. The licensee or registrant shall control the occupational dose to individual adults, except for planned special exposures pursuant to subsection 6, to the following dose limits:
    - (1) An annual limit, which is the more limiting of:

- (a) The total effective dose equivalent being equal to five-hundredths sievert [5 rem]; or
  - (b) The sum of the deep dose equivalent and the committed dose equivalent to any individual organ or tissue other than the lens of the eye being equal to five-tenths sievert [50 rem].
- (2) The annual limits to the lens of the eye, to the skin of the whole body, and to the skin of the extremities, which are:
  - (a) A lens dose equivalent of fifteen-hundredths sievert [15 rem]; and
  - (b) A shallow dose equivalent of five-tenths sievert [50 rem] to the skin of the whole body or to the skin of any extremity.
- b. Doses received in excess of the annual limits, including doses received during accidents, emergencies, and planned special exposures, shall be subtracted from the limits for planned special exposures that the individual may receive during the current year and during the individual's lifetime. See paragraphs 1 and 2 of subdivision e of subsection 6.
- c. The assigned deep dose equivalent must be for the part of the body receiving the highest exposure. The assigned shallow dose equivalent must be the dose averaged over the contiguous ten square centimeters of skin receiving the highest exposure.
  - (1) The deep dose equivalent, lens dose equivalent, and shallow dose equivalent may be assessed from surveys or other radiation measurements for the purpose of demonstrating compliance with the occupational dose limits, if the individual monitoring device was not in the region of highest potential exposure, or the results of individual monitoring are unavailable.
  - (2) When a protective apron is worn while working with medical fluoroscopic equipment and monitoring is conducted as specified in paragraph 5 of subdivision a of subsection 2 of section 33-10-04.1-09, the effective dose equivalent for external radiation shall be determined as follows:
    - (a) When only one individual monitoring device is used and it is located at the neck (collar) outside the protective apron, the reported deep dose equivalent shall be the effective dose equivalent for external radiation.

- (b) When only one individual monitoring device is used and it is located at the neck (collar) outside the protective apron, and the reported dose exceeds twenty-five percent of the limit specified in subdivision a of subsection 1 of section 33-10-04.1-06, the reported deep dose equivalent value multiplied by three-tenths shall be the effective dose equivalent for external radiation.
- (c) When two individual monitoring devices are worn, one under the protective apron at the waist and the other outside the protective apron at the neck, the effective dose equivalent for external radiation shall be assigned the value of the sum of the deep dose equivalent reported for the individual monitoring device located at the waist under the protective apron multiplied by one and five-tenths and the deep dose equivalent reported for the individual monitoring device located at the neck outside the protective apron multiplied by four-hundredths.
- (d) Subparagraphs b and c only apply when all of the following conditions are met:
  - [1] The individual monitoring devices have not been exposed to radiation from radioactive material.
  - [2] Lead glasses, a thyroid shield, and a wrap-around protective apron have been worn whenever using the medical fluoroscopic equipment.
  - [3] The area around the medical fluoroscopic equipment has been equipped with lead shielding or transparent protective barriers for control of scattered radiation.
  - [4] The medical fluoroscopic procedures have been performed in a way that minimizes beam on time, such as utilizing last image hold.
  - [5] Users of the medical fluoroscopic equipment must have had formal training in radiation safety and operation of medical fluoroscopic equipment.
  - [6] Performance of the medical fluoroscopic equipment must be monitored and maintained via a quality assurance program.

[7] Patient and staff radiation exposures from medical fluoroscopic equipment must be monitored and actions taken to correct problems.

- d. Derived air concentration and annual limit on intake values are presented in table I of appendix B and may be used to determine the individual's dose and to demonstrate compliance with the occupational dose limits. See subsection 7 of section 33-10-04.1-15.
- e. Notwithstanding the annual dose limits, the licensee shall limit the soluble uranium intake by an individual to ten milligrams in a week in consideration of chemical toxicity. See footnote 3 of appendix B.
- f. The licensee or registrant shall reduce the dose that an individual may be allowed to receive in the current year by the amount of occupational dose received while employed by any other person. See subdivision e of subsection 5.

**2. Compliance with requirements for summation of external and internal doses.**

- a. If the licensee or registrant is required to monitor pursuant to both subdivision a and subdivision b of subsection 2 of section 33-10-04.1-09, the licensee or registrant shall demonstrate compliance with the dose limits by summing external and internal doses. If the licensee or registrant is required to monitor only pursuant to subdivision a of subsection 2 of section 33-10-04.1-09 or only pursuant to subdivision b of subsection 2 of section 33-10-04.1-09, then summation is not required to demonstrate compliance with the dose limits. The licensee or registrant may demonstrate compliance with the requirements for summation of external and internal doses pursuant to subdivision b, subdivision c, and subdivision d. The dose equivalents for the lens of the eye, the skin, and the extremities are not included in the summation, but are subject to separate limits.
- b. Intake by inhalation. If the only intake of radionuclides is by inhalation, the total effective dose equivalent limit is not exceeded if the sum of the deep dose equivalent divided by the total effective dose equivalent limit, and one of the following, does not exceed unity:
  - (1) The sum of the fractions of the inhalation annual limit on intake for each radionuclide;
  - (2) The total number of derived air concentration-hours (DAC-hours) for all radionuclides divided by two thousand; or

- (3) The sum of the calculated committed effective dose equivalents to all significantly irradiated organs or tissues ( $T$ ) calculated from bioassay data using appropriate biological models and expressed as a fraction of the annual limit. For purposes of this requirement, an organ or tissue is deemed to be significantly irradiated if, for that organ or tissue, the product of the weighting factors,  $w_T$ , and the committed dose equivalent,  $H_{T,50}$ , per unit intake is greater than ten percent of the maximum weighted value of  $H_{T,50}$ , that is,  $w_T H_{T,50}$ , per unit intake for any organ or tissue.
- c. Intake by oral ingestion. If the occupationally exposed individual receives an intake of radionuclides by oral ingestion greater than ten percent of the applicable oral annual limit on intake, the licensee or registrant shall account for this intake and include it in demonstrating compliance with the limits.
- d. Intake through wounds or absorption through skin. The licensee or registrant shall evaluate and, to the extent practical, account for intakes through wounds or skin absorption. The intake through intact skin has been included in the calculation of derived air concentration for hydrogen-3 and does not need to be evaluated or accounted for pursuant to this subdivision.
3. **Determination of external dose from airborne radioactive material.**
- a. Licensees or registrants shall, when determining the dose from airborne radioactive material, include the contribution to the deep dose equivalent, lens dose equivalent, and shallow dose equivalent from external exposure to the radioactive cloud. See appendix B, footnotes 1 and 2.
- b. Airborne radioactivity measurements and derived air concentration values shall not be used as the primary means to assess the deep dose equivalent when the airborne radioactive material includes radionuclides other than noble gases or if the cloud of airborne radioactive material is not relatively uniform. The determination of the deep dose equivalent to an individual shall be based upon measurements using instruments or individual monitoring devices.
4. **Determination of internal exposure.**
- a. For purposes of assessing dose used to determine compliance with occupational dose equivalent limits, the licensee or registrant shall, when required pursuant to subsection 2 of section 33-10-04.1-09, take suitable and timely measurements of:

- (1) Concentrations of radioactive materials in air in work areas;

- (2) Quantities of radionuclides in the body;
  - (3) Quantities of radionuclides excreted from the body; or
  - (4) Combinations of these measurements.
- b. Unless respiratory protection equipment is used, as provided in subsection 3 of section 33-10-04.1-11, or the assessment of intake is based on bioassays, the licensee or registrant shall assume that an individual inhales radioactive material at the airborne concentration in which the individual is present.
- c. When specific information on the physical and biochemical properties of the radionuclides taken into the body or the behavior of the material in an individual is known, the licensee or registrant may:
  - (1) Use that information to calculate the committed effective dose equivalent, and, if used, the licensee or registrant shall document that information in the individual's record;
  - (2) Upon prior approval of the department, adjust the derived air concentration or annual limit on intake values to reflect the actual physical and chemical characteristics of airborne radioactive material, for example, aerosol size distribution or density; and
  - (3) Separately assess the contribution of fractional intakes of class D, W, or Y compounds of a given radionuclide to the committed effective dose equivalent. See appendix B.
- d. If the licensee or registrant chooses to assess intakes of class Y material using the measurements given in paragraph 2 or 3 of subdivision a, the licensee or registrant may delay the recording and reporting of the assessments for periods up to seven months, unless otherwise required by subsection 2 or 3 of section 33-10-04.1-16. This delay permits the licensee or registrant to make additional measurements basic to the assessments.
- e. If the identity and concentration of each radionuclide in a mixture are known, the fraction of the derived air concentration applicable to the mixture for use in calculating derived air concentration-hours shall be either:
  - (1) The sum of the ratios of the concentration to the appropriate derived air concentration value, that is, D, W, or Y, from appendix B for each radionuclide in the mixture; or

- (2) The ratio of the total concentration for all radionuclides in the mixture to the most restrictive derived air concentration value for any radionuclide in the mixture.
- f. If the identity of each radionuclide in a mixture is known, but the concentration of one or more of the radionuclides in the mixture is not known, the derived air concentration for the mixture shall be the most restrictive derived air concentration of any radionuclide in the mixture.
- 9. When a mixture of radionuclides in air exists, a licensee or registrant may disregard certain radionuclides in the mixture if:
  - (1) The licensee or registrant uses the total activity of the mixture in demonstrating compliance with the dose limits in subsection 1 and in complying with the monitoring requirements in subdivision b of subsection 2 of section 33-10-04.1-09;
  - (2) The concentration of any radionuclide disregarded is less than ten percent of its derived air concentration; and
  - (3) The sum of these percentages for all of the radionuclides disregarded in the mixture does not exceed thirty percent.
- h. When determining the committed effective dose equivalent, the following information may be considered:
  - (1) In order to calculate the committed effective dose equivalent, the licensee or registrant may assume that the inhalation of one annual limit on intake, or an exposure of two thousand derived air concentration-hours, results in a committed effective dose equivalent of five-hundredths sievert [5 rem] for radionuclides that have their annual limit on intakes or derived air concentrations based on the committed effective dose equivalent.
  - (2) For an annual limit on intake and the associated derived air concentration determined by the nonstochastic organ dose limit of five-tenths sievert [50 rem], the intake of radionuclides that would result in a committed effective dose equivalent of five-hundredths sievert [5 rem], that is, the stochastic annual limit on intake, is listed in parentheses in table I of appendix B. As a simplifying assumption, the licensee or registrant may use the stochastic annual limit on intake to determine committed effective dose equivalent. However, if the licensee or registrant uses the stochastic annual limit on intake, the licensee or registrant shall also demonstrate that

the limit in subparagraph 2 of paragraph 1 of subdivision a of subsection 1 is met.

**5. Determination of prior occupational dose.**

- a. For each individual who is likely to receive, in a year, an occupational dose requiring monitoring pursuant to subsection 2 of section 33-10-04.1-09, the licensee or registrant shall:
  - (1) Determine the occupational radiation dose received during the current year; and
  - (2) Attempt to obtain the records of cumulative occupational radiation dose.
- b. Prior to permitting an individual to participate in a planned special exposure, the licensee or registrant shall determine:
  - (1) The internal and external doses from all previous planned special exposures;
  - (2) All doses in excess of the limits, including doses received during accidents and emergencies, received during the lifetime of the individual; and
  - (3) All lifetime cumulative occupational radiation dose.
- c. In complying with the requirements of subdivision a, a licensee or registrant may:
  - (1) Accept, as a record of the occupational dose that the individual received during the current year, a written signed statement from the individual, or from the individual's most recent employer for work involving radiation exposure, that discloses the nature and the amount of any occupational dose that the individual received during the current year;
  - (2) Accept, as the record of cumulative radiation dose, an up-to-date department's occupational radiation exposure history form (SFN 19443) or equivalent, signed by the individual and countersigned by an appropriate official of the most recent employer for work involving radiation exposure, or the individual's current employer, if the individual is not employed by the licensee or registrant; and
  - (3) Obtain reports of the individual's dose equivalent from the most recent employer for work involving radiation exposure, or the individual's current employer, if the individual is not employed by the licensee or registrant, by telephone,

telegram, facsimile, electronic media, or letter. The licensee or registrant shall request a written verification of the dose data if the authenticity of the transmitted report cannot be established.

- d. (1) The licensee or registrant shall record the exposure history, as required by subdivision a, on the department's occupational radiation exposure history form (SFN 19443), or other clear and legible record, of all the information required on that form. The form or record shall show each period in which the individual received occupational exposure to radiation or radioactive material and shall be signed by the individual who received the exposure. For each period for which the licensee or registrant obtains reports, the licensee or registrant shall use the dose shown in the report in preparing the department's occupational radiation exposure history form (SFN 19443) or equivalent. For any period in which the licensee or registrant does not obtain a report, the licensee or registrant shall place a notation on the department's occupational radiation exposure history form (SFN 19443) or equivalent indicating the periods of time for which data are not available.

- (2) Licensees or registrants are not required to reevaluate the separate external dose equivalents and internal committed dose equivalents or intakes of radionuclides assessed pursuant to the rules in chapter 33-10-04 in effect before January 1, 1994. Further, occupational exposure histories obtained and recorded on the department's occupational radiation exposure history form (SFN 19443) or equivalent before January 1, 1994, would not have included effective dose equivalent, but may be used in the absence of specific information on the intake of radionuclides by the individual.

- e. If the licensee or registrant is unable to obtain a complete record of an individual's current and previously accumulated occupational dose, the licensee or registrant shall assume:

- (1) In establishing administrative controls pursuant to subdivision f of subsection 1 for the current year, that the allowable dose limit for the individual is reduced by twelve and five-tenths millisieverts [1.25 rem] for each quarter for which records were unavailable and the individual was engaged in activities that could have resulted in occupational radiation exposure; and
- (2) That the individual is not available for planned special exposures.

- f. The licensee or registrant shall retain the records on the department's occupational radiation exposure history form (SFN 19443) or equivalent until the department terminates each pertinent license or registration requiring this record. The licensee or registrant shall retain records used in preparing the department's occupational radiation exposure history form (SFN 19443) or equivalent for three years after the record is made.
6. **Planned special exposures.** A licensee or registrant may authorize an adult worker to receive doses in addition to and accounted for separately from the doses received under the limits specified in subsection 1 provided that each of the following conditions is satisfied:
- a. The licensee or registrant authorizes a planned special exposure only in an exceptional situation when alternatives that might avoid the dose estimated to result from the planned special exposure are unavailable or impractical.
  - b. The licensee or registrant, and employer if the employer is not the licensee or registrant, specifically authorizes the planned special exposure, in writing, before the exposure occurs.
  - c. Before a planned special exposure, the licensee or registrant ensures that each individual involved is:
    - (1) Informed of the purpose of the planned operation;
    - (2) Informed of the estimated doses and associated potential risks and specific radiation levels or other conditions that might be involved in performing the task; and
    - (3) Instructed in the measures to be taken to keep the dose as low as reasonably achievable considering other risks that may be present.
  - d. Prior to permitting an individual to participate in a planned special exposure, the licensee or registrant ascertains prior doses as required by subdivision b of subsection 5 during the lifetime of the individual for each individual involved.
  - e. Subject to subdivision b of subsection 1, the licensee or registrant shall not authorize a planned special exposure that would cause an individual to receive a dose from all planned special exposures and all doses in excess of the limits to exceed:
    - (1) The numerical values of any of the dose limits in subdivision a of subsection 1 in any year; and

- (2) Five times the annual dose limits in subdivision a of subsection 1 during the individual's lifetime.
- f. The licensee or registrant maintains records of the conduct of a planned special exposure in accordance with subsection 6 of section 33-10-04.1-15 and submits a written report in accordance with subsection 4 of section 33-10-04.1-16.
- 9. The licensee or registrant records the best estimate of the dose resulting from the planned special exposure in the individual's record and informs the individual, in writing, of the dose within thirty days from the date of the planned special exposure. The dose from planned special exposures shall not be considered in controlling future occupational dose of the individual pursuant to subdivision a of subsection 1 but shall be included in evaluations required by subdivisions d and e.
- 7. **Occupational dose limits for minors.** The annual occupational dose limits for minors are ten percent of the annual occupational dose limits specified for adult workers in subsection 1.
- 8. **Dose equivalent to the embryo or fetus.**
  - a. The licensee or registrant shall ensure that the dose equivalent to the embryo or fetus during the entire pregnancy, due to occupational exposure of a declared pregnant woman, does not exceed five millisievert [0.5 rem]. See subsection 7 of section 33-10-04.1-15 for recordkeeping requirements.
  - b. The licensee or registrant shall make efforts to avoid substantial variation above a uniform monthly exposure rate to a declared pregnant woman so as to satisfy the limit in subdivision a (the national council on radiation protection and measurements recommended in NCRP report No. 91 "Recommendations on Limits for Exposure to Ionizing Radiation" (June 1, 1987) that no more than five-tenths millisievert [0.05 rem] to the embryo or fetus be received in any one month).
  - c. The dose equivalent to the embryo or fetus shall be taken as the sum of:
    - (1) The deep dose equivalent to the declared pregnant woman; and
    - (2) The dose equivalent to the embryo or fetus from radionuclides in the embryo or fetus and radionuclides in the declared pregnant woman.

- d. If by the time the woman declares pregnancy to the licensee or registrant, the dose equivalent to the embryo or fetus has exceeded four and five-tenths millisievert [0.45 rem], the licensee or registrant shall be deemed to be in compliance with subdivision a of subsection 8 of section 33-10-04.1-06 if the additional dose equivalent to the embryo or fetus does not exceed five-tenths millisievert [0.05 rem] during the remainder of the pregnancy.

**History:** Effective March 1, 1994; amended effective July 1, 1995; May 1, 1998; March 1, 2003.

**General Authority:** NDCC 23-20.1-04

**Law Implemented:** NDCC 23-20.1-03, 23-20.1-04

**33-10-04.1-07. Radiation dose limits for individual members of the public.**

**1. Dose limits for individual members of the public.**

- a. Each licensee or registrant shall conduct operations so that:
  - (1) The total effective dose equivalent to individual members of the public from the licensed or registered operation does not exceed one millisievert [0.1 rem] in a year, exclusive of the dose contribution from background radiation, from any medical administration the individual has received, from exposure to individuals administered radioactive material and released in accordance with section 33-10-07.1-32, voluntary participation in medical research programs, and from the licensee's or registrant's disposal of radioactive material into sanitary sewerage in accordance with subsection 3 of section 33-10-04.1-14. Retrofit shall not be required for locations within facilities where only radiation machines existed prior to January 1, 1994, and met the previous requirements of five millisievert [0.5 rem] in a year; and
  - (2) The dose in any unrestricted area from external sources exclusive of the dose contributions from patients administered radioactive material and released in accordance with subsection 12 of section 33-10-07-05 does not exceed two-hundredths millisievert [0.002 rem] in any one hour.
- b. If the licensee or registrant permits members of the public to have access to restricted areas, the limits for members of the public continue to apply to those individuals.
- c. Notwithstanding paragraph 1 of subdivision a of subsection 1 of this section, a licensee may permit visitors to an individual who cannot

be released, under section 33-10-07.1-32, to receive a radiation dose greater than one millisievert [100 millirems] if:

- (1) The radiation dose received does not exceed five millisieverts [500 millirems]; and
  - (2) The authorized user, as defined in chapter 33-10-07.1, has determined before the visit that it is appropriate.
- d. A licensee, registrant, or an applicant for a license or registration may apply for prior department authorization to operate up to an annual dose limit for an individual member of the public of five millisieverts [0.5 rem]. This application shall include the following information:
- (1) Demonstration of the need for and the expected duration of operations in excess of the limit in subdivision a;
  - (2) The licensee's or registrant's program to assess and control dose within the five millisieverts [0.5 rem] annual limit; and
  - (3) The procedures to be followed to maintain the dose as low as reasonably achievable.
- e. In addition to the requirements of this chapter, a licensee or registrant subject to the provisions of the United States environmental protection agency's generally applicable environmental radiation standards in 40 CFR 190 shall comply with those standards.
- f. The department may impose additional restrictions on radiation levels in unrestricted areas and on the total quantity of radionuclides that a licensee or registrant may release in effluents in order to restrict the collective dose.

**2. Compliance with dose limits for individual members of the public.**

- a. The licensee or registrant shall make or cause to be made surveys of radiation levels in unrestricted areas and radioactive materials in effluents released to unrestricted areas to demonstrate compliance with the dose limits for individual members of the public in subsection 1.
- b. A licensee or registrant shall show compliance with the annual dose limit in subsection 1 by:
  - (1) Demonstrating by measurement or calculation that the total effective dose equivalent to the individual likely to receive the

highest dose from the licensed or registered operation does not exceed the annual dose limit; or

(2) Demonstrating that:

- (a) The annual average concentrations of radioactive material released in gaseous and liquid effluents at the boundary of the unrestricted area do not exceed the values specified in table II of appendix B; and
  - (b) If an individual were continuously present in an unrestricted area, the dose from external sources would not exceed two-hundredths millisievert [0.002 rem] in an hour and five-tenths millisievert [0.05 rem] in a year.
- c. Upon approval from the department, the licensee or registrant may adjust the effluent concentration values in appendix B, table II, for members of the public, to take into account the actual physical and chemical characteristics of the effluents, such as, aerosol size distribution, solubility, density, radioactive decay equilibrium, and chemical form.

**History:** Effective March 1, 1994; amended effective May 1, 1998; March 1, 2003.

**General Authority:** NDCC 28-32-02

**Law Implemented:** NDCC 23-20.1-03, 23-20.1-04

**33-10-04.1-08. Testing for leakage or contamination of sealed sources.**

1. The licensee or registrant in possession of any sealed source shall assure that:
  - a. Each sealed source, except as specified in subsection 2, is tested for leakage or contamination and the test results are received before the sealed source is put into use unless the licensee or registrant has a certificate from the transferor indicating that the sealed source was tested within six months before transfer to the licensee or registrant.
  - b. Each sealed source that is not designed to emit alpha particles is tested for leakage or contamination at intervals not to exceed six months or at alternative intervals approved by the department, after evaluation of information specified by paragraphs 4 and 5 of subdivision k of subsection 5 of section 33-10-03-05, an agreement state, a licensing state, or the United States nuclear regulatory commission.
  - c. Each sealed source that is designed to emit alpha particles is tested for leakage or contamination at intervals not to exceed three

months or at alternative intervals approved by the department, after evaluation of information specified by paragraphs 4 and 5 of subdivision j of subsection 5 of section 33-10-03-05, an agreement state, a licensing state, or the United States nuclear regulatory commission.

- d. For each sealed source that is required to be tested for leakage or contamination, at any other time there is reason to suspect that the sealed source might have been damaged or might be leaking, the licensee or registrant shall assure that the sealed source is tested for leakage or contamination before further use.
- e. Tests for leakage for all sealed sources, except brachytherapy sources manufactured to contain radium, shall be capable of detecting the presence of one hundred eighty-five becquerels [0.005  $\mu$ Ci] of radioactive material on a test sample. Test samples shall be taken from the sealed source or from the surfaces of the container in which the sealed source is stored or mounted on which one might expect contamination to accumulate. For a sealed source contained in a device, test samples are obtained when the source is in the "off" position.
- f. The test for leakage for brachytherapy sources manufactured to contain radium shall be capable of detecting an absolute leakage rate of thirty-seven becquerels [0.001  $\mu$ Ci] of radon-222 in a twenty-four-hour period when the collection efficiency for radon-222 and its daughters has been determined with respect to collection method, volume, and time.
- g. Tests for contamination from radium daughters shall be taken on the interior surface of brachytherapy source storage containers and shall be capable of detecting the presence of one hundred eighty-five becquerels [0.005  $\mu$ Ci] of a radium daughter which has a half-life greater than four days.
- 2. A licensee or registrant need not perform test for leakage or contamination on the following sealed sources:
  - a. Sealed sources containing only radioactive material with a half-life of less than thirty days;
  - b. Sealed sources containing only radioactive material as a gas;
  - c. Sealed sources containing three and seven-tenths megabecquerels [100  $\mu$ Ci] or less of beta or photon-emitting material or three hundred seventy kilobecquerels [10  $\mu$ Ci] or less of alpha-emitting material;
  - d. Sealed sources containing only hydrogen-3;

- e. Seeds of iridium-192 encased in nylon ribbon; and
  - f. Sealed sources, except teletherapy and brachytherapy sources, which are stored, not being used and identified as in storage. The licensee or registrant shall, however, test each such sealed source for leakage or contamination and receive the test results before any use or transfer unless it has been tested for leakage or contamination within six months before the date of use or transfer.
- 3. Tests for leakage or contamination from sealed sources shall be performed by persons specifically authorized by the department, an agreement state, a licensing state, or the United States nuclear regulatory commission to perform such services.
  - 4. Test results shall be kept in units of becquerel or microcurie and maintained for inspection by the department. Records of test results for sealed sources shall be made pursuant to subsection 4 of section 33-10-04.1-15.
  - 5. The following shall be considered evidence that a sealed source is leaking:
    - a. The presence of one hundred eighty-five becquerels [0.005  $\mu$ Ci] or more of removable contamination on any test sample.
    - b. Leakage of thirty-seven becquerels [0.001  $\mu$ Ci] of radon-222 per twenty-hour hours for brachytherapy sources manufactured to contain radium.
    - c. The presence of removable contamination resulting from the decay of one hundred eighty-five becquerels [0.005  $\mu$ Ci] or more of radium.
  - 6. The licensee or registrant shall immediately withdraw a leaking sealed source from use and shall take action to prevent the spread of contamination. The leakage sealed source shall be repaired or disposed of in accordance with this section.
  - 7. Reports of test results for leaking or contaminated sealed sources shall be made pursuant to subsection 8 of section 33-10-04.1-16.

**History:** Effective March 1, 1994; amended effective July 1, 1995; March 1, 2003.

**General Authority:** NDCC 23-20.1-04

**Law Implemented:** NDCC 23-20.1-03, 23-20.1-04

### **33-10-04.1-09. Survey and monitoring.**

#### **1. General.**

- a. Each licensee or registrant shall make, or cause to be made, surveys that:
  - (1) Are necessary for the licensee or registrant to comply with this chapter; and
  - (2) Are reasonable under the circumstances to evaluate:
    - (a) The magnitude and extent of radiation levels;
    - (b) Concentrations or quantities of radioactive material; and
    - (c) The potential radiological hazards that could be present.
- b. The licensee or registrant shall ensure that instruments and equipment used for quantitative radiation measurements, for example, dose rate and effluent monitoring, are calibrated at intervals not to exceed twelve months for the radiation measured except when a more frequent interval is specified in another applicable section of these rules or a license condition.
- c. All personnel dosimeters, except for direct and indirect reading pocket ionization chambers and those dosimeters used to measure the dose to any extremity, that require processing to determine the radiation dose and that are used by licensees and registrants to comply with subsection 1 of section 33-10-04.1-06, with other provisions of this article, or with conditions specified in a license or registration shall be processed and evaluated by a dosimetry processor:
  - (1) Holding current personnel dosimetry accreditation from the national voluntary laboratory accreditation program (NVLAP) of the national institute of standards and technology; and
  - (2) Approved in this accreditation process for the type of radiation or radiations included in the national voluntary laboratory accreditation program that most closely approximates the type of radiation or radiations for which the individual wearing the dosimeter is monitored.

- d. The licensee or registrant shall ensure that adequate precautions are taken to prevent a deceptive exposure of an individual monitoring device.
2. **Conditions requiring individual monitoring of external and internal occupational dose.** Each licensee or registrant shall monitor exposures from sources of radiation at levels sufficient to demonstrate compliance with the occupational dose limits of this chapter. At a minimum:
- a. Each licensee or registrant shall monitor occupational exposure to radiation from licensed and unlicensed radiation sources under the control of the licensee and shall supply and require the use of individual monitoring devices by:
    - (1) Adults likely to receive, in one year from sources external to the body, a dose in excess of ten percent of the limits in subdivision a of subsection 1 of section 33-10-04.1-06;
    - (2) Minors likely to receive, in one year from radiation sources external to the body, a deep dose equivalent in excess of one millisievert [100 millirems], a lens dose equivalent in excess of one and five-tenths millisieverts [150 millirems], or a shallow dose equivalent to the skin of the whole body or to the skin of any extremity in excess of five millisieverts [500 millirems] (the assigned shallow dose equivalent must be the dose averaged over the contiguous ten square centimeters of skin receiving the highest exposure);
    - (3) Declared pregnant women likely to receive during the entire pregnancy, from radiation sources external to the body a deep dose equivalent in excess of one millisievert [100 millirems];
    - (4) Individuals entering a high or very high radiation area; and
    - (5) Individuals working with medical fluoroscopic equipment.
      - (a) An individual monitoring device used for the dose to an embryo or fetus of a declared pregnant woman, pursuant to subdivision a of subsection 8 of section 33-10-04.1-06, shall be located under the protective apron at the waist.
      - (b) An individual monitoring device used for lens dose equivalent shall be located at the neck (collar), or an unshielded location closer to the eye, outside the protective apron.

- (c) When only one individual monitoring device is used to determine the effective dose equivalent for external radiation pursuant to paragraph 2 of subdivision c of subsection 1 of section 33-10-04.1-06, it shall be located at the neck (collar) outside the protective apron. When a second individual monitoring device is used, for the same purpose, it shall be located under the protective apron at the waist. The second individual monitoring device is required for a declared pregnant woman.
- b. Each licensee or registrant shall monitor, to determine compliance with subsection 4 of section 33-10-04.1-06, the occupational intake of radioactive material by and assess the committed effective dose equivalent to:
  - (1) Adults likely to receive, in one year, an intake in excess of ten percent of the applicable annual limit on intake in table I, columns 1 and 2, of appendix B;
  - (2) Minors likely to receive, in one year, a committed effective dose equivalent in excess of one-tenth millisievert [10 millirems]; and
  - (3) Declared pregnant women likely to receive, during the entire pregnancy, a committed effective dose equivalent in excess of one millisievert [100 millirems].
- 3. **Location of individual monitoring devices.** Each licensee or registrant shall ensure that individuals who are required to monitor occupational doses in accordance with subdivision a of subsection 2 wear individual monitoring devices as follows:
  - a. An individual monitoring device used for monitoring the dose to the whole body shall be worn at the unshielded location of the whole body likely to receive the highest exposure. When a protective apron is worn, the location of the individual monitoring device is typically at the neck (collar);
  - b. An individual monitoring device used for monitoring the dose to an embryo or fetus of a declared pregnant woman, pursuant to subdivision a of subsection 8 of section 33-10-04.1-06, shall be located at the waist under any protective apron being worn by the woman;
  - c. An individual monitoring device used for monitoring the lens dose equivalent, to demonstrate compliance with subparagraph a of paragraph 2 of subdivision a of subsection 1 of section 33-10-04.1-06, shall be located at the neck (collar), outside any

protective apron being worn by the monitored individual, or at an unshielded location closer to the eye; and

- d. An individual monitoring device used for monitoring the dose to the extremities, to demonstrate compliance with subparagraph b of paragraph 2 of subdivision a of subsection 1 of section 33-10-04.1-06, shall be worn on the extremity likely to receive the highest exposure. Each individual monitoring device shall be oriented to measure the highest dose to the extremity being monitored.

**History:** Effective March 1, 1994; amended effective July 1, 1995; March 1, 2003.

**General Authority:** NDCC 23-20.1-04

**Law Implemented:** NDCC 23-20.1-03, 23-20.1-04

**33-10-04.1-10. Control of exposure from external sources in restricted areas.**

**1. Control of access to high radiation areas.**

- a. The licensee or registrant shall ensure that each entrance or access point to a high radiation area has one or more of the following features:
  - (1) A control device that, upon entry into the area, causes the level of radiation to be reduced below that level at which an individual might receive a deep dose equivalent of one millisievert [0.1 rem] in one hour at thirty centimeters from the source of radiation or from any surface that the radiation penetrates;
  - (2) A control device that energizes a conspicuous visible or audible alarm signal so that the individual entering the high radiation area and the supervisor of the activity are made aware of the entry; or
  - (3) Entryways that are locked, except during periods when access to the areas is required, with positive control over each individual entry.
- b. In place of the controls required by subdivision a of subsection 1 for a high radiation area, the licensee or registrant may substitute continuous direct or electronic surveillance that is capable of preventing unauthorized entry.
- c. The licensee or registrant may apply to the department for approval of alternative methods for controlling access to high radiation areas.

- d. The licensee or registrant shall establish the controls required by subdivisions a and c of subsection 1 in a way that does not prevent individuals from leaving a high radiation area.
- e. The licensee or registrant is not required to control each entrance or access point to a room or other area that is a high radiation area solely because of the presence of radioactive materials prepared for transport and packaged and labeled in accordance with the rules of the United States department of transportation provided that:
  - (1) The packages do not remain in the area longer than three days; and
  - (2) The dose rate at one meter from the external surface of any package does not exceed one-tenth millisievert [0.01 rem] per hour.
- f. The licensee or registrant is not required to control entrance or access to rooms or other areas in hospitals solely because of the presence of patients containing radioactive material, provided that there are personnel in attendance who are taking the necessary precautions to prevent the exposure of individuals to radiation or radioactive material in excess of the established limits in this chapter and to operate within the as low as is reasonably achievable provisions of the licensee's or registrant's radiation protection program.
- 9. The registrant is not required to control entrance or access to rooms or other areas containing sources of radiation capable of producing a high radiation area as described in subsection 1 if the registrant has met all the specific requirements for access and control specified in other applicable parts of this article, such as, chapter 33-10-05 for industrial radiography, chapter 33-10-06 for X-rays in the healing arts, and chapter 33-10-09 for particle accelerators.

**2. Control of access to very high radiation areas.**

- a. In addition to the requirements in subsection 1, the licensee or registrant shall institute measures to ensure that an individual is not able to gain unauthorized or inadvertent access to areas in which radiation levels could be encountered at five gray [500 rad] or more in one hour at one meter from a source of radiation or any surface through which the radiation penetrates. This requirement does not apply to rooms or areas in which diagnostic X-ray systems are the only source of radiation, or to nonself-shielded irradiators.

- b. The registrant is not required to control entrance or access to rooms or other areas containing sources of radiation capable of producing a very high radiation area as described in subdivision a if the registrant has met all the specific requirements for access and control specified in other applicable parts of this article, such as, chapter 33-10-05 for industrial radiography, chapter 33-10-06 for x-rays in the healing arts, and chapter 33-10-09 for particle accelerators.

3. **Control of access to very high radiation areas - Irradiators.**

- a. This subsection applies to licensees or registrants with sources of radiation in nonself-shielded irradiators. This subsection does not apply to sources of radiation that are used in teletherapy, in industrial radiography, or in completely self-shielded irradiators in which the source of radiation is both stored and operated within the same shielding radiation barrier and, in the designed configuration of the irradiator, is always physically inaccessible to any individual and cannot create high levels of radiation in an area that is accessible to any individual.
- b. Each area in which there may exist radiation levels in excess of five gray [500 rad] in one hour at one meter from a source of radiation that is used to irradiate materials shall meet the following requirements:
  - (1) Each entrance or access point shall be equipped with entry control devices which:
    - (a) Function automatically to prevent any individual from inadvertently entering a very high radiation area;
    - (b) Permit deliberate entry into the area only after a control device is actuated that causes the radiation level within the area, from the source of radiation, to be reduced below that at which it would be possible for an individual to receive a deep dose equivalent in excess of one millisievert [0.1 rem] in one hour; and
    - (c) Prevent operation of the source of radiation if it would produce radiation levels in the area that could result in a deep dose equivalent to an individual in excess of one millisievert [0.1 rem] in one hour.
  - (2) Additional control devices shall be provided so that, upon failure of the entry control devices to function as required by paragraph 1:

- (a) The radiation level within the area, from the source of radiation, is reduced below that at which it would be possible for an individual to receive a deep dose equivalent in excess of one millisievert [0.1 rem] in one hour; and
  - (b) Conspicuous visible and audible alarm signals are generated to make an individual attempting to enter the area aware of the hazard and at least one other authorized individual, who is physically present, familiar with the activity, and prepared to render or summon assistance, aware of the failure of the entry control devices.
- (3) The licensee or registrant shall provide control devices so that, upon failure or removal of physical radiation barriers other than the sealed source's shielded storage container:
  - (a) The radiation level from the source of radiation is reduced below that at which it would be possible for an individual to receive a deep dose equivalent in excess of one millisievert [0.1 rem] in one hour; and
  - (b) Conspicuous visible and audible alarm signals are generated to make potentially affected individuals aware of the hazard and the licensee or registrant or at least one other individual, who is familiar with the activity, and prepared to render or summon assistance, aware of the failure or removal of the physical barrier.
- (4) When the shield for stored sealed sources is a liquid, the licensee or registrant shall provide means to monitor the integrity of the shield and to signal, automatically, loss of adequate shielding.
- (5) Physical radiation barriers that comprise permanent structural components, such as walls, that have no credible probability of failure or removal in ordinary circumstances need not meet the requirements of paragraphs 3 and 4.
- (6) Each area shall be equipped with devices that will automatically generate conspicuous visible and audible alarm signals to alert personnel in the area before the source of radiation can be put into operation and in time for any individual in the area to operate a clearly identified control device, which must be installed in the area and which can prevent the source of radiation from being put into operation.

- (7) Each area shall be controlled by use of such administrative procedures and such devices as are necessary to ensure that the area is cleared of personnel prior to each use of the source of radiation.
  - (8) Each area shall be checked by a radiation measurement to ensure that, prior to the first individual's entry into the area after any use of the source of radiation, the radiation level from the source of radiation in the area is below that at which it would be possible for an individual to receive a deep dose equivalent in excess of one millisievert [0.1 rem] in one hour.
  - (9) The entry control devices required in paragraph 1 shall be tested for proper functioning. See subsection 10 of section 33-10-04.1-15 for recordkeeping requirements.
    - (a) Testing shall be conducted prior to initial operation with the source of radiation on any day, unless operations were continued uninterrupted from the previous day;
    - (b) Testing shall be conducted prior to resumption of operation of the source of radiation after any unintentional interruption; and
    - (c) The licensee or registrant shall submit and adhere to a schedule for periodic tests of the entry control and warning systems.
  - (10) The licensee or registrant shall not conduct operations, other than those necessary to place the source of radiation in safe condition or to effect repairs on controls, unless control devices are functioning properly.
  - (11) Entry and exit portals that are used in transporting materials to and from the irradiation area, and that are not intended for use by individuals, shall be controlled by such devices and administrative procedures as are necessary to physically protect and warn against inadvertent entry by any individual through these portals. Exit portals for irradiated materials shall be equipped to detect and signal the presence of any loose radioactive material that is carried toward such an exit and automatically to prevent loose radioactive material from being carried out of the area.
- C. Licensees, registrants, or applicants for licenses or registrations for sources of radiation within the purview of subdivision b which will be used in a variety of positions or in locations, such as open fields or forests, that make it impracticable to comply with certain requirements of subdivision b, such as those for the

automatic control of radiation levels, may apply to the department for approval of alternative safety measures. Alternative safety measures shall provide personnel protection at least equivalent to those specified in subdivision b. At least one of the alternative measures shall include an entry-preventing interlock control based on a measurement of the radiation that ensures the absence of high radiation levels before an individual can gain access to the area where such sources of radiation are used.

- d. The entry control devices required by subdivisions b and c shall be established in such a way that no individual will be prevented from leaving the area.

**History:** Effective March 1, 1994.

**General Authority:** NDCC 23-20.1-04

**Law Implemented:** NDCC 23-20.1-03, 23-20.1-04

**33-10-04.1-11. Respiratory protection and controls to restrict internal exposure in restricted areas.**

1. **Use of process or other engineering controls.** The licensee or registrant shall use, to the extent practical, process or other engineering controls, such as containment, decontamination, or ventilation, to control the concentrations of radioactive material in air.
2. **Use of other controls.**
  - a. When it is not practical to apply process or other engineering controls to control the concentrations of radioactive material in air to values below those that define an airborne radioactivity area, the licensee or registrant, consistent with maintaining the total effective dose equivalent as low as is reasonably achievable (ALARA), shall increase monitoring and limit intakes by one or more of the following means:
    - (1) Control of access;
    - (2) Limitation of exposure times;
    - (3) Use of respiratory protection equipment; or
    - (4) Other controls.
  - b. If the licensee performs an as low as reasonably achievable (ALARA) analysis to determine whether or not respirators should be used, the licensee may consider safety factors other than radiological factors. The licensee should also consider the impact of respirator use on workers' industrial health and safety.

### **3. Use of individual respiratory protection equipment.**

- a. If the licensee or registrant assigns or permits the use of respiratory protection equipment to limit intake of radioactive material pursuant to subsection 2:
  - (1) Except as otherwise provided in this section, the licensee or registrant shall use only respiratory protection equipment that is tested and certified by the national institute for occupational safety and health (NIOSH).
  - (2) The licensee or registrant may use respiratory protection equipment that has not been tested or certified by the national institute for occupational safety and health, or for which there is no schedule for testing or certification, provided the licensee or registrant has submitted to the department and the department has approved an application for authorized use of that respiratory protection equipment, including a demonstration by testing, or a demonstration on the basis of test information, that the material and performance characteristics of the respiratory protection equipment are capable of providing the proposed degree of protection under anticipated conditions of use.
  - (3) The licensee or registrant shall implement and maintain a respiratory protection program that includes:
    - (a) Air sampling sufficient to identify the potential hazard, permit proper respiratory protection equipment selection, and estimate doses;
    - (b) Surveys and bioassays, as appropriate, to evaluate actual intakes;
    - (c) Testing of respiratory protection equipment for operability, including user seal check for face sealing devices and functional check for others, immediately prior to each use;
    - (d) Written procedures regarding:
      - [1] Monitoring, including air sampling and bioassays;
      - [2] Supervision and training of respirator users;
      - [3] Fit testing;
      - [4] Respirator selection;

- [5] Breathing air quality;
  - [6] Inventory and control;
  - [7] Storage, issuance, maintenance, repair, testing, and quality assurance of respiratory protection equipment;
  - [8] Recordkeeping;
  - [9] Limitations on periods of respirator use and relief from respirator use;
  - [10] The use of process or other engineering controls, instead of respiratory protection equipment; and
  - [11] The routine, nonroutine, and emergency use of respiratory protection equipment;
- (e) Determination by a physician that the individual user is medically fit to use respiratory protection equipment, before:
- [1] The initial fitting of a face sealing respirator;
  - [2] Before the first field use of nonface sealing respirators; and
  - [3] Either every twelve months thereafter, or periodically at a frequency determined by a physician; and
- (f) Fit testing, with fit factor greater than or equal to ten times the assigned protection factor for negative pressure devices, and a fit factor greater than or equal to five hundred for any positive pressure, continuous flow, and pressure-demand devices, before the first field use of tight-fitting, face-sealing respirators and periodically thereafter at a frequency not to exceed one year. Fit testing must be performed with the facepiece operating in the negative pressure mode.
- (4) The licensee or registrant shall advise each respiratory protection equipment user that the user may leave the area at any time for relief from respiratory protection equipment use in the event of equipment malfunction, physical or psychological distress, procedural or communication failure, significant deterioration of operating conditions, or any other conditions that might require such relief.

- (5) The licensee or registrant shall use respirator protection equipment within the equipment manufacturer's expressed limitations for type and mode of use. The licensee or registrant shall also consider limitations appropriate to the type and mode of use. When selecting respiratory devices the licensee or registrant shall provide for vision correction, adequate communication, low temperature work environments, and the concurrent use of other safety or radiological protection equipment. The licensee or registrant shall use equipment in such a way as not to interfere with the proper operation of the respirator and shall consider other special capabilities, such as adequate skin protection, when needed.
- (6) Standby rescue persons are required whenever one-piece atmosphere-supplying suits, or any combination of supplied air respiratory protection device and personnel protective equipment are used from which an unaided individual would have difficulty extricating himself or herself. The standby persons must be equipped with respiratory protection devices or other apparatus appropriate for the potential hazards. The standby rescue persons shall observe or otherwise maintain continuous communication with the workers (visual, voice, signal line, telephone, radio, or other suitable means), and be immediately available to assist them in case of a failure of the air supply or for any other reason that requires relief from distress. A sufficient number of standby rescue persons must be immediately available to assist all users of this type of equipment and to provide effective emergency rescue if needed.
- (7) Atmosphere-supplying respirators must be supplied with respirable air of grade D quality or better as defined by the compressed gas association in publication G-7.1, "Commodity Specification for Air" 1997 and included in the regulations of the United States occupational safety and health administration [29 CFR 1910.134(i)(1)(ii)(A) through (E)]. Grade D quality air criteria, including:
- (a) Oxygen content (v/v) of 19.5 through 23.5 percent;
  - (b) Hydrocarbon (condensed) content of five milligrams per cubic meter of air or less;
  - (c) Carbon monoxide (CO) content of ten parts per million or less;
  - (d) Carbon dioxide content of one thousand parts per million or less; and

- (e) Lack of noticeable odor.
- (8) The licensee shall ensure that no objects, materials, or substances, such as facial hair, or any conditions that interfere with the face to facepiece seal or valve function, and that are under the control of the respirator wearer, are present between the skin of the wearer's face and the sealing surface of a tight-fitting respirator facepiece.
- b. When estimating dose to individuals from intake of airborne radioactive materials, the concentration of radioactive material in the air that is inhaled when respirators are worn is initially assumed to be the ambient concentration in air without respiratory protection, divided by the assigned protection factor. If the dose is later found to be greater than initially estimated, the corrected value shall be used; however, if the exposure is later found to be less than initially estimated, the corrected value may be used.
- 4. **Further restrictions on the use of respiratory protection equipment.** The department may impose restrictions in addition to those in subsection 2, subsection 3, and appendix A to:
  - a. Ensure that the respiratory protection program of the licensee or registrant is adequate to limit doses to individuals from intakes of airborne radioactive materials consistent with maintaining total effective dose equivalent as low as reasonably achievable; and
  - b. Limit the extent to which a licensee or registrant may use respiratory protection equipment instead of process controls or other engineering controls.
- 5. **Application for use of higher assigned protection factors.** The licensee or registrant shall obtain authorization from the department before using assigned protection factors in excess of those specified in appendix A. The department may authorize a licensee or registrant to use higher assigned protection factors on receipt of an application that:
  - a. Describes the situation for which a need exists for higher protection factors; and
  - b. Demonstrates that the respiratory protection equipment provides these higher protection factors under the proposed conditions of use.

**History:** Effective March 1, 1994; amended effective July 1, 1995; May 1, 1998; March 1, 2003.

**General Authority:** NDCC 23-20.1-04

**Law Implemented:** NDCC 23-20.1-03, 23-20.1-04

**33-10-04.1-12. Security and control of licensed or registered sources of radiation.**

1. The licensee or registrant shall secure radioactive material from unauthorized removal or access.
2. The licensee or registrant shall maintain constant surveillance and use devices or administrative procedures to prevent unauthorized use of radioactive material that is in an unrestricted area and that is not in storage.
3. The registrant shall secure registered radiation machines from unauthorized removal.
4. The registrant shall use devices or administrative procedures to prevent unauthorized use of registered radiation machines.

**History:** Effective March 1, 1994; amended effective March 1, 2003.

**General Authority:** NDCC 23-20.1-04

**Law Implemented:** NDCC 23-20.1-03, 23-20.1-04

**33-10-04.1-13. Precautionary procedures.**

**1. Caution signs.**

- a. Standard radiation symbol. Unless otherwise authorized by the department, the symbol prescribed by this subsection shall use the colors magenta, or purple, or black on yellow background. The symbol prescribed is the three-bladed design as shown in appendix H.
- b. Exception to color requirements for standard radiation symbol. Notwithstanding the requirements of subdivision a, licensees or registrants are authorized to label sources, source holders, or device components containing sources of radiation that are subjected to high temperatures, with conspicuously etched or stamped radiation caution symbols and without a color requirement.
- c. Additional information on signs and labels. In addition to the contents of signs and labels prescribed in this chapter, the licensee or registrant shall provide, on or near the required signs and labels, additional information, as appropriate, to make individuals aware of potential radiation exposures and to minimize the exposures.

## **2. Posting requirements.**

- a. Posting of radiation areas. The licensee or registrant shall post each radiation area with a conspicuous sign or signs bearing the radiation symbol and the words "CAUTION: RADIATION AREA".
- b. Posting of high radiation areas. The licensee or registrant shall post each high radiation area with a conspicuous sign or signs bearing the radiation symbol and the words "CAUTION: HIGH RADIATION AREA" or "DANGER: HIGH RADIATION AREA".
- c. Posting of very high radiation areas. The licensee or registrant shall post each very high radiation area with a conspicuous sign or signs bearing the radiation symbol and words "GRAVE DANGER: VERY HIGH RADIATION AREA".
- d. Posting of airborne radioactivity areas. The licensee or registrant shall post each airborne radioactivity area with a conspicuous sign or signs bearing the radiation symbol and the words "CAUTION: AIRBORNE RADIOACTIVITY AREA" or "DANGER: AIRBORNE RADIOACTIVITY AREA".
- e. Posting of areas or rooms in which licensed or registered material is used or stored. The licensee or registrant shall post each area or room in which there is used or stored an amount of licensed or registered material exceeding ten times the quantity of such material specified in appendix C with a conspicuous sign or signs bearing the radiation symbol and the words "CAUTION: RADIOACTIVE MATERIAL" or "DANGER: RADIOACTIVE MATERIAL".

## **3. Exceptions to posting requirements.**

- a. A licensee or registrant is not required to post caution signs in areas or rooms containing sources of radiation for periods of less than eight hours, if each of the following conditions is met:
  - (1) The sources of radiation are constantly attended during these periods by an individual who takes the precautions necessary to prevent the exposure of individuals to sources of radiation in excess of the limits established in this chapter; and
  - (2) The area or room is subject to the licensee's or registrant's control.
- b. Rooms or other areas in hospitals that are occupied by patients are not required to be posted with caution signs pursuant to subsection 2 provided that the patient could be released from control pursuant to subsection 12 of section 33-10-07-05.

- c. A room or area is not required to be posted with a caution sign because of the presence of a sealed source provided the radiation level at thirty centimeters from the surface of the sealed source container or housing does not exceed five hundredths millisievert [0.005 rem] per hour.
- d. A room or area is not required to be posted with a caution sign because of the presence of radiation machines used solely for diagnosis in the healing arts.

**4. Labeling containers and radiation machines.**

- a. The licensee or registrant shall ensure that each container of licensed or registered material bears a durable, clearly visible label bearing the radiation symbol and the words "CAUTION: RADIOACTIVE MATERIAL" or "DANGER: RADIOACTIVE MATERIAL". The label shall also provide information, such as the radionuclides present, an estimate of the quantity of radioactivity, the date for which the activity is estimated, radiation levels, kinds of materials, and mass enrichment, to permit individuals handling or using the containers, or working in the vicinity of the containers, to take precautions to avoid or minimize exposures.
- b. Each licensee or registrant shall, prior to removal or disposal of empty uncontaminated containers to unrestricted areas, remove or deface the radioactive material label or otherwise clearly indicate that the container no longer contains radioactive materials.
- c. Each registrant shall ensure that each radiation machine is labeled in a conspicuous manner which cautions individuals that radiation is produced when it is energized.

**5. Exemptions to labeling requirements.** A licensee or registrant is not required to label:

- a. Containers holding licensed or registered material in quantities less than the quantities listed in appendix C;
- b. Containers holding licensed or registered material in concentrations less than those specified in table III of appendix B;
- c. Containers attended by an individual who takes the precautions necessary to prevent the exposure of individuals in excess of the limits established by this chapter;
- d. Containers when they are in transport and packaged and labeled in accordance with the rules of the United States department of transportation (Labeling of packages containing radioactive

materials is required by the United States department of transportation if the amount and type of radioactive material exceeds the limits for an excepted quantity or article as defined and limited by United States department of transportation rules 49 CFR 173.403(m) and (w) and 173.421-424.);

- e. Containers that are accessible only to individuals authorized to handle or use them, or to work in the vicinity of the containers, if the contents are identified to these individuals by a readily available written record. Examples of containers of this type are containers in locations such as water-filled canals, storage vaults, or hot cells. The record shall be retained as long as the containers are in use for the purpose indicated on the record; or
- f. Installed manufacturing or process equipment, such as piping and tanks.

**6. Procedures for receiving and opening packages.**

- a. Each licensee or registrant who expects to receive a package containing quantities of radioactive material in excess of a type A quantity, as defined in section 33-10-13-02 and appendix A of chapter 33-10-13, shall make arrangements to receive:
  - (1) The package when the carrier offers it for delivery; or
  - (2) The notification of the arrival of the package at the carrier's terminal and to take possession of the package expeditiously.
- b. Each licensee or registrant shall:
  - (1) Monitor the external surfaces of a labeled package for radioactive contamination unless the package contains only radioactive material in the form of gas or in special form as defined in section 33-10-01-04. Labeled package means posted with a radioactive white I, yellow II, or yellow III label as specified in United States department of transportation rules 49 CFR 172.403 and 172.436-440;
  - (2) Monitor the external surfaces of a labeled package for radiation levels unless the package contains quantities of radioactive material that are less than or equal to the type A quantity, as defined in section 33-10-13-02 and appendix A of chapter 33-10-13. Labeled package means posted with a radioactive white I, yellow II, or yellow III label as specified in United States department of transportation rules 49 CFR 172.403 and 172.436-440; and

- (3) Monitor all packages known to contain radioactive material for radioactive contamination and radiation levels if there is evidence of degradation of package integrity, such as packages that are crushed, wet, or damaged.
- c. The licensee or registrant shall perform the monitoring required by subdivision b as soon as practical after receipt of the package, but not later than three hours after the package is received at the licensee's or registrant's facility if it is received during the licensee's or registrant's normal working hours or if there is evidence of degradation of package integrity, such as a package that is crushed, wet, or damaged. If a package is received after working hours and has no evidence of degradation of package integrity, the package shall be monitored no later than three hours from the beginning of the next working day.
- d. The licensee or registrant shall immediately notify the final delivery carrier and, the department by telephone in accordance with contact information in section 33-10-01-13 when:
  - (1) Removable radioactive surface contamination exceeds the limits of subsection 8 of section 33-10-13-15; or
  - (2) External radiation levels exceed the limits of subsections 9 and 10 of section 33-10-13-15.
- e. Each licensee or registrant shall:
  - (1) Establish, maintain, and retain written procedures for safely opening packages in which radioactive material is received; and
  - (2) Ensure that the procedures are followed and that due consideration is given to special instructions for the type of package being opened.
- f. Licensees or registrants transporting special form sources in vehicles owned or operated by the licensee or registrant to and from a worksite are exempt from the contamination monitoring requirements of subdivision b, but are not exempt from the monitoring requirement in subdivision b for measuring radiation levels that ensures that the source is still properly lodged in its shield.

**History:** Effective March 1, 1994; amended effective July 1, 1995; May 1, 1998; March 1, 2003.

**General Authority:** NDCC 23-20.1-04

**Law Implemented:** NDCC 23-20.1-03, 23-20.1-04

### **33-10-04.1-14. Waste disposal.**

#### **1. General requirements.**

- a. A licensee or registrant shall dispose of licensed or registered material only:
  - (1) By transfer to an authorized recipient as provided in subsection 6 or in chapter 33-10-03, or to the United States department of energy;
  - (2) By decay in storage;
  - (3) By release in effluents within the limits in subsection 1 of section 33-10-04.1-07; or
  - (4) As authorized pursuant to subsection 2, 3, 4, or 5.
- b. A person shall be specifically licensed or registered to receive waste containing licensed or registered material from other persons for:
  - (1) Treatment prior to disposal;
  - (2) Treatment or disposal by incineration;
  - (3) Decay in storage;
  - (4) Disposal at a land disposal facility licensed pursuant to 10 CFR 61; or
  - (5) Storage until transferred to a storage or disposal facility authorized to receive the waste.

#### **2. Method for obtaining approval of proposed disposal procedures.**

A licensee or registrant or applicant for a license or registration may apply to the department for approval of proposed procedures, not otherwise authorized in this article, to dispose of licensed or registered material generated in the licensee's or registrant's operations. Each application shall include:

- a. A description of the waste containing licensed or registered material to be disposed of, including the physical and chemical properties that have an impact on risk evaluation, and the proposed manner and conditions of waste disposal;
- b. An analysis and evaluation of pertinent information on the nature of the environment;

- c. The nature and location of other potentially affected facilities; and
- d. Analyses and procedures to ensure that doses are maintained as low as is reasonably achievable and within the dose limits in this chapter.

**3. Disposal by release into sanitary sewerage.**

- a. A licensee or registrant may discharge licensed or registered material into sanitary sewerage if each of the following conditions is satisfied:
  - (1) The material is readily soluble, or is readily dispersible biological material, in water;
  - (2) The quantity of licensed or registered radioactive material that the licensee or registrant releases into the sewer in one month divided by the average monthly volume of water released into the sewer by the licensee or registrant does not exceed the concentration listed in table III of appendix B;
  - (3) If more than one radionuclide is released, the following conditions must also be satisfied:
    - (a) The licensee or registrant shall determine the fraction of the limit in table III of appendix B represented by discharges into sanitary sewerage by dividing the actual monthly average concentration of each radionuclide released by the licensee or registrant into the sewer by the concentration of that radionuclide listed in table III of appendix B; and
    - (b) The sum of the fractions for each radionuclide required by subparagraph a does not exceed unity; and
  - (4) The total quantity of licensed or registered radioactive material that the licensee or registrant releases into the sanitary sewerage in a year does not exceed one hundred eighty-five gigabecquerels [5  $\mu$ Ci] of hydrogen-3, thirty-seven gigabecquerels [1  $\mu$ Ci] of carbon-14, and 37 gigabecquerels [1  $\mu$ Ci] of all other radioactive materials combined.
- b. Excreta from individuals undergoing medical diagnosis or therapy with radioactive material are not subject to the limitations contained in subdivision a.

**4. Treatment or disposal by incineration.** A licensee or registrant may treat or dispose of licensed or registered material by incineration only in

the form and concentration specified in subsection 5 or as specifically approved by the department pursuant to subsection 2.

**5. Disposal of specific wastes.**

- a. A licensee or registrant may dispose of the following licensed or registered material as if it were not radioactive:
  - (1) One and eighty-five one-hundredths kilobecquerels [0.05  $\mu$ Ci], or less, of hydrogen-3 or carbon-14 per gram of medium used for liquid scintillation counting; and
  - (2) One and eighty-five one-hundredths kilobecquerels [0.05  $\mu$ Ci], or less, of hydrogen-3 or carbon-14 per gram of animal tissue, averaged over the weight of the entire animal.
- b. A licensee or registrant shall not dispose of tissue pursuant to paragraph 2 of subdivision a in a manner that would permit its use either as food for humans or as animal feed.
- c. The licensee or registrant shall maintain records in accordance with subsection 9 of section 33-10-04.1-15.

**6. Transfer for disposal and manifests.**

- a. The requirements of this subsection and appendix G are designed to:
  - (1) Control transfers of low-level radioactive waste by any waste generator, waste collector, or waste processor licensee, as defined in appendix G, who ships low-level waste either directly, or indirectly through a waste collector or waste processor, to a licensed low-level waste land disposal facility;
  - (2) Establish a manifest tracking system; and
  - (3) Supplement existing requirements concerning transfers and recordkeeping for those wastes.
- b. Any licensee shipping radioactive waste intended for ultimate disposal at a licensed land disposal facility must document the information required on the uniform low-level radioactive waste manifest and transfer this recorded manifest information to the intended consignee in accordance with appendix G.
- c. Each shipment manifest shall include a certification by the waste generator as specified in section II of appendix G.

- d. Each person involved in the transfer of waste for disposal or in the disposal of waste, including the waste generator, waste collector, waste processor, and disposal facility operator, shall comply with the requirements specified in section III of appendix G.
7. **Compliance with environmental and health protection rules.** Nothing in subsection 1, 2, 3, 4, 5, or 6 relieves the licensee or registrant from complying with other applicable federal, state, and local rules governing any other toxic or hazardous properties of materials that may be disposed of in accordance with subsection 1, 2, 3, 4, 5, or 6.

**History:** Effective March 1, 1994; amended effective July 1, 1995; May 1, 1998; March 1, 2003.

**General Authority:** NDCC 23-20.1-04

**Law Implemented:** NDCC 23-20.1-04.1

### **33-10-04.1-15. Records.**

- 1. General provisions.
  - a. Each licensee or registrant shall use the international system units becquerel, gray, sievert, and coulomb per kilogram, or the special units curie, rad, rem, and roentgen, including multiples and subdivisions, and shall clearly indicate the units of all quantities on records required by this chapter.
  - b. Notwithstanding the requirements of subdivision a, when recording information on shipment manifests, as required in paragraph 2 of subdivision b of subsection 6 of section 33-10-04.1-14, information must be recorded in the international system of units or in the international system of units and units as specified in subdivision a.
  - c. The licensee or registrant shall make a clear distinction among the quantities entered on the records required by this chapter, such as, total effective dose equivalent, total organ dose equivalent, shallow dose equivalent, lens dose equivalent, deep dose equivalent, or committed effective dose equivalent.
- 2. Records of radiation protection programs.
  - a. Each licensee or registrant shall maintain records of the radiation protection program, including:
    - (1) The provisions of the program; and
    - (2) Audits and other reviews of program content and implementation.

- b. The licensee or registrant shall retain the records required by paragraph 1 of subdivision a until the department terminates each pertinent license or registration requiring the record. The licensee or registrant shall retain the records required by paragraph 2 of subdivision a for three years after the record is made.
- 3. Records of surveys.
  - a. Each licensee or registrant shall maintain records showing the results of surveys and calibrations required by subsection 1 of section 33-10-04.1-09 and subdivision b of subsection 6 of section 33-10-04.1-13. The licensee or registrant shall retain these records for three years after the record is made.
  - b. The licensee or registrant shall retain each of the following records until the department terminates each pertinent license or registration requiring the record:
    - (1) Records of the results of surveys to determine the dose from external sources of radiation, and used in the absence of or in combination with individual monitoring data in the assessment of individual dose equivalents;
    - (2) Records of the results of measurements and calculations used to determine individual intakes of radioactive material and used in the assessment of internal dose;
    - (3) Records showing the results of air sampling, surveys, and bioassays required pursuant to subparagraphs a and b of paragraph 3 of subdivision a of subsection 3 of section 33-10-04.1-11; and
    - (4) Records of the results of measurements and calculations used to evaluate the release of radioactive effluents to the environment. This includes those records of the results of measurements and calculations used to evaluate the release of radioactive effluents to the environment required under the standards for protection against radiation in effect prior to March 1, 1994.
  - c. Upon termination of the license or registration, the licensee or registrant shall permanently store records on the department's occupational radiation exposure history form (SFN 19443) or equivalent, or shall make provision with the department for transfer to the department.
- 4. Records of tests for leakage or contamination of sealed sources. Records of tests for leakage or contamination of sealed sources (required by subsection 1 of section 33-10-04.1-08) shall be kept in

units of becquerel or microcurie and maintained for inspection by the department for five years after the records are made.

5. Records of prior occupational dose.
  - a. The licensee or registrant shall retain the records of prior occupational dose and exposure history as specified in subsection 5 of section 33-10-04.1-06 on the department's occupational radiation exposure history form (SFN 19443) or equivalent until the department terminates each pertinent license or registration requiring this record. The licensee or registrant shall retain records used in preparing the department's occupational radiation exposure history form (SFN 19443) or equivalent for three years after the record is made.
  - b. Upon termination of the license or registration, the licensee or registrant shall permanently store records on the department's occupational radiation exposure history form (SFN 19443) or equivalent, or shall make provision with the department for transfer to the department.
6. Records of planned special exposures.
  - a. For each use of the provisions of subsection 6 of section 33-10-04.1-06 for planned special exposures, the licensee or registrant shall maintain records that describe:
    - (1) The exceptional circumstances requiring the use of a planned special exposure;
    - (2) The name of the management official who authorized the planned special exposure and a copy of the signed authorization;
    - (3) What actions were necessary;
    - (4) Why the actions were necessary;
    - (5) What precautions were taken to assure that doses were maintained as low as is reasonably achievable;
    - (6) What individual and collective doses were expected to result; and
    - (7) The doses actually received in the planned special exposure.
  - b. The licensee or registrant shall retain the records until the department terminates each pertinent license or registration requiring these records.

- c. Upon termination of the license or registration, the licensee or registrant shall permanently store records on the department's occupational radiation exposure history form (SFN 19443) or equivalent, or shall make provision with the department for transfer to the department.
- 7. Records of individual monitoring results.
  - a. Recordkeeping requirement. Each licensee or registrant shall maintain records of doses received by all individuals for whom monitoring was required pursuant to subsection 2 of section 33-10-04.1-09, and records of doses received during planned special exposures, accidents, and emergency conditions. These records shall include, when applicable:
    - (1) The deep dose equivalent to the whole body, lens dose equivalent to the eye, shallow dose equivalent to the skin, and shallow dose equivalent to the extremities;
    - (2) The estimated intake of radionuclides, see subsection 2 of section 33-10-04.1-06;
    - (3) The committed effective dose equivalent assigned to the intake of radionuclides;
    - (4) The specific information used to calculate the committed effective dose equivalent pursuant to subdivisions a and c of subsection 4 of section 33-10-04.1-06 and when required by subsection 2 of section 33-10-04.1-09;
    - (5) The total effective dose equivalent when required by subsection 2 of section 33-10-04.1-06; and
    - (6) The total of the deep dose equivalent and the committed dose to the organ receiving the highest total dose.
  - b. Recordkeeping frequency. The licensee or registrant shall make entries of the records specified in subdivision a at intervals not to exceed one year.
  - c. Recordkeeping format. The licensee or registrant shall maintain the records specified in subdivision a on the department's current occupational radiation exposure form (SFN 8416), in accordance with the instructions for the department's current occupational radiation exposure form (SFN 8416), or in clear and legible records containing all the information required by the department's current occupational radiation exposure form (SFN 8416).

- d. The licensee or registrant shall maintain the records of dose equivalent to the embryo or fetus with the records of dose to the declared pregnant woman. The declaration of pregnancy, including the estimated date of conception, shall also be kept on file, but may be maintained separately from the dose records.
  - e. The licensee or registrant shall retain each required form or record until the department terminates each pertinent license or registration requiring the record.
  - f. Upon termination of the license or registration, the licensee or registrant shall permanently store records on the department's occupational radiation exposure history form (SFN 19443) or equivalent, or shall make provision with the department for transfer to the department.
8. Records of dose to individual members of the public.
- a. Each licensee or registrant shall maintain records sufficient to demonstrate compliance with the dose limit for individual members of the public. See subsection 1 of section 33-10-04.1-07.
  - b. The licensee or registrant shall retain the records required by subdivision a until the department terminates each pertinent license or registration requiring the record.
9. Records of waste disposal.
- a. Each licensee or registrant shall maintain records of the disposal of licensed or registered materials made pursuant to subsection 2, 3, 4, or 5 of section 33-10-04.1-14, chapter 33-10-03, or disposal by burial in soil, including burials authorized before October 1, 1982.
  - b. The licensee or registrant shall retain the records required by subdivision a until the department terminates each pertinent license or registration requiring the record.
- Requirements for disposition of these records, prior to license termination, are located in subsection 14 of section 33-10-03-05 and in sections 33-10-04.1-14 and 33-10-04.1-15 for activities licensed or registered under this article.
10. Records of testing entry control devices for very high radiation areas.
- a. Each licensee or registrant shall maintain records of tests made pursuant to paragraph 9 of subdivision b of subsection 3 of section 33-10-04.1-10 on entry control devices for very high radiation areas. These records must include the date, time, and results of each such test of function.

- b. The licensee or registrant shall retain the records required by subdivision a for three years after the record is made.
- 11. Form of records. Each record required by this chapter shall be legible throughout the specified retention period. The record shall be the original or a reproduced copy or a microform, provided that the copy or microform is authenticated by authorized personnel and that the microform is capable of producing a clear copy throughout the required retention period or the record may also be stored in electronic media with the capability for producing legible, accurate, and complete records during the required retention period. Records, such as letters, drawings, and specifications, shall include all pertinent information, such as stamps, initials, and signatures. The licensee shall maintain adequate safeguards against tampering with and loss of records.
- 12. Prior to license termination, each licensee authorized to possess radioactive material with a half-life greater than one hundred twenty days, in an unsealed form, shall forward the following records to the department:
  - a. Records of disposal of licensed material made under subsection 2 of section 33-10-04.1-14 including records of burials made before the effective date of this section, and subsections 3, 4, and 5 of section 33-10-04.1-14; and
  - b. Records required by paragraph 4 of subdivision b of subsection 3 of section 33-10-04.1-15.
- 13. If licensed activities are transferred or assigned in accordance with subdivision b of subsection 7 of section 33-10-03-05, each licensee authorized to possess radioactive material, with a half-life greater than one hundred twenty days, in an unsealed form, shall transfer the following records to the new licensee and the new licensee will be responsible for maintaining these records until the licensee is terminated:
  - a. Records of disposal of licensed material made under subsection 2 of section 33-10-04.1-14 including burials made before the effective date of this section, and subsections 3, 4, and 5 of section 33-10-04.1-14; and
  - b. Records required by paragraph 4 of subdivision b of subsection 3 of section 33-10-04.1-15.

14. Prior to license termination, each licensee shall forward the records required by subdivision g of subsection 14 of section 33-10-03-05 to the department.

**History:** Effective March 1, 1994; amended effective May 1, 1998; March 1, 2003.

**General Authority:** NDCC 23-20.1-04

**Law Implemented:** NDCC 23-20.1-03, 23-20.1-04, 23-20.1-09.1

### **33-10-04.1-16. Reports.**

#### **1. Reports of stolen, lost, or missing licensed or registered sources of radiation.**

- a. Telephone reports. Each licensee or registrant shall report to the department by telephone as follows:

- (1) Immediately after its occurrence becomes known to the licensee or registrant, stolen, lost, or missing licensed or registered radioactive material in an aggregate quantity equal to or greater than one thousand times the quantity specified in appendix C under such circumstances that it appears to the licensee or registrant that an exposure could result to individuals in unrestricted areas;
- (2) Within thirty days after its occurrence becomes known to the licensee or registrant, lost, stolen, or missing licensed or registered radioactive material in an aggregate quantity greater than ten times the quantity specified in appendix C that is still missing; and
- (3) Immediately after its occurrence becomes known to the registrant, a stolen, lost, or missing radiation machine.

- b. Written reports. Each licensee or registrant required to make a report pursuant to subdivision a, within thirty days after making the telephone report, shall make a written report to the department setting forth the following information:

- (1) A description of the licensed or registered source of radiation involved, including, for radioactive material, the kind, quantity, and chemical and physical form; and, for radiation machines, the manufacturer, model and serial number, type and maximum energy of radiation emitted;
- (2) A description of the circumstances under which the loss or theft occurred;
- (3) A statement of disposition, or probable disposition, of the licensed or registered source of radiation involved;

- (4) Exposures of individuals to radiation, circumstances under which the exposures occurred, and the possible total effective dose equivalent to persons in unrestricted areas;
  - (5) Actions that have been taken, or will be taken, to recover the source of radiation; and
  - (6) Procedures or measures that have been, or will be, adopted to ensure against a recurrence of the loss or theft of licensed or registered sources of radiation.
- c. Subsequent to filing the written report, the licensee or registrant shall also report additional substantive information on the loss or theft within thirty days after the licensee or registrant learns of such information.
- d. The licensee or registrant shall prepare any report filed with the department pursuant to this subsection so that names of individuals who may have received exposure to radiation are stated in a separate and detachable portion of the report.

## **2. Notification of incidents.**

- a. Immediate notification. Notwithstanding other requirements for notification, each licensee or registrant shall immediately report each event involving a source of radiation possessed by the licensee or registrant that may have caused or threatens to cause any of the following conditions:
- (1) An individual to receive:
    - (a) A total effective dose equivalent of twenty-five one-hundredths sievert [25 rem] or more;
    - (b) A lens dose equivalent of seventy-five one-hundredths sievert [75 rem] or more; or
    - (c) A shallow dose equivalent to the skin or extremities or a total organ dose equivalent of two and five-tenths gray [250 rad] or more; or
  - (2) The release of radioactive material, inside or outside of a restricted area, so that, had an individual been present for twenty-four hours, the individual could have received an intake five times the annual limit on intake. This provision does not apply to locations where personnel are not normally stationed during routine operations, such as hot-cells or process enclosures.

- b. Twenty-four-hour notification. Each licensee or registrant, within twenty-four hours of discovery of the event, shall report to the department each event involving loss of control of a licensed or registered source of radiation possessed by the licensee or registrant that may have caused, or threatens to cause, any of the following conditions:
    - (1) An individual to receive, in a period of twenty-four hours:
      - (a) A total effective dose equivalent exceeding five-hundredths sievert [5 rem];
      - (b) A lens dose equivalent exceeding fifteen-hundredths sievert [15 rem]; or
      - (c) A shallow dose equivalent to the skin or extremities or a total organ dose equivalent exceeding five-tenths sievert [50 rem]; or
    - (2) The release of radioactive material, inside or outside of a restricted area, so that, had an individual been present for twenty-four hours, the individual could have received an intake in excess of one annual limit on intake. This provision does not apply to locations where personnel are not normally stationed during routine operations, such as hot-cells or process enclosures.
  - c. The licensee or registrant shall prepare each report filed with the department pursuant to this subsection so that names of individuals who have received exposure to sources of radiation are stated in a separate and detachable portion of the report.
  - d. Licensees or registrants shall make the reports required by subdivisions a and b to the department by telephone, in accordance with contact information contained in section 33-10-01-13.
  - e. The provisions of this subsection do not apply to doses that result from planned special exposures, provided such doses are within the limits for planned special exposures and are reported pursuant to subsection 4.
3. **Reports of exposures, radiation levels, and concentrations of radioactive material exceeding the constraints or limits.**
- a. Reportable events. In addition to the notification required by subsection 2, each licensee or registrant shall submit a written report within thirty days after learning of any of the following occurrences:

- (1) Incidents for which notification is required by subsection 2;
- (2) Doses in excess of any of the following:
  - (a) The occupational dose limits for adults in subsection 1 of section 33-10-04.1-06;
  - (b) The occupational dose limits for a minor in subsection 7 of section 33-10-04.1-06;
  - (c) The limits for an embryo or fetus of a declared pregnant woman in subsection 8 of section 33-10-04.1-06;
  - (d) The limits for an individual member of the public in subsection 1 of section 33-10-04.1-07;
  - (e) Any applicable limit in the license or registration; or
  - (f) The as low as is reasonably achievable (ALARA) constraints for air emissions established under subsection 2 of section 33-10-04.1-05;
- (3) Levels of radiation or concentrations of radioactive material in:
  - (a) A restricted area in excess of applicable limits in the license or registration; or
  - (b) An unrestricted area in excess of ten times the applicable limit set forth in this chapter or in the license or registration, whether or not involving exposure of any individual in excess of the limits in subsection 1 of section 33-10-04.1-07; or
- (4) For licensees subject to the provisions of United States environmental protection agency's generally applicable environmental radiation standards in 40 CFR 190, levels of radiation or releases of radioactive material in excess of those standards, or of license conditions related to those standards.

b. Contents of reports.

- (1) Each report required by subdivision a shall describe the extent of exposure of individuals to radiation and radioactive material, including, as appropriate:
  - (a) Estimates of each individual's dose;

- (b) The levels of radiation and concentrations of radioactive material involved;
  - (c) The cause of the elevated exposures, dose rates, or concentrations; and
  - (d) Corrective steps taken or planned to ensure against a recurrence, including the schedule for achieving conformance with applicable limits, as low as is reasonably achievable (ALARA) constraints, generally applicable environmental standards, and associated license or registration conditions.
- (2) Each report filed pursuant to subdivision a shall include for each occupationally overexposed individual: the name, social security account number, and date of birth. With respect to the limit for the embryo or fetus in subsection 8 of section 33-10-04.1-06, the identifiers should be those of the declared pregnant woman. The report shall be prepared so that this information is stated in a separate and detachable portion of the report.
- c. All licensees or registrants who make reports pursuant to subdivision a shall submit the report in writing to the department.
- 4. **Reports of planned special exposures.** The licensee or registrant shall submit a written report to the department within thirty days following any planned special exposure conducted in accordance with subsection 6 of section 33-10-04.1-06, informing the department that a planned special exposure was conducted and indicating the date the planned special exposure occurred and the information required by subsection 6 of section 33-10-04.1-15.
- 5. **Reporting requirements.**
  - a. Immediate report. Each licensee shall notify the department as soon as possible but not later than four hours after the discovery of an event that prevents immediate protective actions necessary to avoid exposures to radiation or radioactive materials that could exceed regulatory limits or releases of licensed material that could exceed regulatory limits (events may include fires, explosions, toxic gas releases, etc.).
  - b. Twenty-four-hour report. Each licensee shall notify the department within twenty-four hours after the discovery of any of the following events involving licensed material:
    - (1) An unplanned contamination event that:

- (a) Requires access to the contaminated area, by workers or the public, to be restricted for more than twenty-four hours by imposing additional radiological controls or by prohibiting entry into the area;
  - (b) Involves a quantity of material greater than five times the lowest annual limit on intake specified in appendix B of this chapter for the material; and
  - (c) Has access to the area restricted for a reason other than to allow isotopes with a half-life of less than twenty-four hours to decay prior to decontamination.
- (2) An event in which equipment is disabled or fails to function as designed when:
  - (a) The equipment is required by rule or license condition to prevent releases exceeding regulatory limits, to prevent exposures to radiation and radioactive materials exceeding regulatory limits, or to mitigate the consequences of an accident;
  - (b) The equipment is required to be available and operable when it is disabled or fails to function; and
  - (c) No redundant equipment is available and operable to perform the required safety function.
- (3) An event that requires unplanned medical treatment at a medical facility of an individual with spreadable radioactive contamination on the individual's clothing or body.
- (4) An unplanned fire or explosion damaging any licensed material or any device, container, or equipment containing licensed material when:
  - (a) The quantity of material involved is greater than five times the lowest annual limit on intake specified in appendix B of this chapter for the material; and
  - (b) The damage affects the integrity of the licensed material or its container.
- c. Preparation and submission of reports. Reports made by licensees in response to the requirements of this section must be made as follows:
  - (1) Licensees shall make reports required by subdivisions a and b by telephone to the department. To the extent that

the information is available at the time of notification, the information provided in these reports must include:

- (a) The caller's name and callback telephone number;
  - (b) A description of the event, including date and time;
  - (c) The exact location of the event;
  - (d) The isotopes, quantities, and chemical and physical form of the licensed material involved; and
  - (e) Any personnel radiation exposure data available.
- (2) Written report. Each licensee who makes a report required by subdivisions a and b shall submit a written followup report within thirty days of the initial report. Written reports prepared pursuant to other rules may be submitted to fulfill this requirement if the reports contain all of the necessary information and the appropriate distribution is made.
- (a) A description of the event, including the probable cause and the manufacturer and model number (if applicable) of any equipment that failed or malfunctioned;
  - (b) The exact location of the event;
  - (c) The isotopes, quantities, and chemical and physical form of the licensed material involved;
  - (d) Date and time of the event;
  - (e) Corrective actions taken or planned and the results of any evaluations or assessments; and
  - (f) The extent of exposure of individuals to radiation or to radioactive materials without identification of individuals by name.

## **6. Reports of individual monitoring.**

- a. This section applies to each person licensed or registered by the department to:
  - (1) Possess or use sources of radiation for purposes of industrial radiography pursuant to chapters 33-10-03 and 33-10-05;
  - (2) Receive radioactive waste from other persons for disposal pursuant to chapter 33-10-03; or

- (3) Possess or use at any time, for processing or manufacturing for distribution pursuant to chapter 33-10-03 or 33-10-07, radioactive material in quantities exceeding any one of the following quantities:

Radionuclide	Activity <sup>a</sup>	
	Ci	GBq
Cesium-137	1	37
Cobalt-60	1	37
Gold-198	100	3,700
Iodine-131	1	37
Iridium-192	10	370
Krypton-85	1,000	37,000
Promethium-147	10	370
Technetium-99m	1,000	37,000

<sup>a</sup> The department may require as a license condition, or by rule, or order pursuant to section 33-10-01-09, reports from licensees or registrants who are licensed or registered to use radionuclides not on this list, in quantities sufficient to cause comparable radiation levels.

- b. Each licensee or registrant in a category listed in subdivision a shall submit an annual report of the results of individual monitoring carried out by the licensee or registrant for each individual for whom monitoring was required by subsection 2 of section 33-10-04.1-09 during that year. The licensee or registrant may include additional data for individuals for whom monitoring was provided but not required. The licensee or registrant shall use the department's current occupational radiation exposure form (SFN 8416) or equivalent or electronic media containing all the information required by the department's current occupational radiation exposure form (SFN 8416).
- c. The licensee or registrant shall file the report required by subdivision b, covering the preceding year, on or before April thirtieth of each year. The licensee or registrant shall submit the report to the department.

## **7. Notifications and reports to individuals.**

- a. Requirements for notification and reports to individuals of exposure to radiation or radioactive material are specified in subsection 3 of section 33-10-10-02.

- b. When a licensee or registrant is required pursuant to this section to report to the department any exposure of an individual to radiation or radioactive material, the licensee or registrant shall also provide the individual a copy of the report submitted to the department. Such reports shall be transmitted at a time not later than the transmittal to the department.

8. **Reports of leaking or contaminated sealed sources.** The licensee or registrant shall file a report within five days with the department if the test for leakage or contamination required pursuant to subsection 1 of section 33-10-04.1-08 indicates a sealed source is leaking or contaminated. The report shall include the equipment involved, the test results, and the corrective action taken.

**History:** Effective March 1, 1994; amended effective July 1, 1995; May 1, 1998; March 1, 2003.

**General Authority:** NDCC 23-20.1-04

**Law Implemented:** NDCC 23-20.1-03, 23-20.1-04, 23-20.1-09.1

**33-10-04.1-17. Additional requirements - Vacating premises.** Each specific licensee or registrant shall, no less than thirty days before vacating or relinquishing possession or control of premises which may have been contaminated with radioactive material as a result of that person's activities, notify the department in writing of intent to vacate. When deemed necessary by the department, the licensee shall decontaminate the premises in accordance with the following or in such other manner as the department may specify.

1. **Premises.** Each licensee before vacating any premises, or transferring the premises shall permanently decontaminate such premises to meet the criteria for decommissioning in section 33-10-04.1-18. A survey shall be made after such decontamination and the department and the landlord or subsequent tenant or transferee shall be provided with a copy of such survey no less than thirty days before vacating or relinquishing possession or control of premises. No such premises may be vacated, sold, or transferred until the decontamination survey has been verified and accepted by the department.
2. **Equipment.** No machinery, instruments, laboratory equipment, or any other property used in contact with, or close proximity to radioactive material at a licensed premises may be assigned, sold, leased, or transferred to an unlicensed person unless such property has been permanently decontaminated below or equal to the standards specified in appendix F. A survey shall be made after such decontamination and the department and subsequent transferee or owner shall be provided with a copy of such survey. No such equipment may be assigned,

sold, leased, or transferred until such documentation survey has been verified and accepted by the department.

**History:** Effective March 1, 1994; amended effective May 1, 1998.

**General Authority:** NDCC 23-20.1-04

**Law Implemented:** NDCC 23-20.1-03, 23-20.1-04, 23-20.1-04.1

### **33-10-04.1-18. Radiological criteria for license termination.**

#### **1. General provisions.**

- a. The criteria in this section apply to the license termination of licensed facilities.
- b. The criteria in this section do not apply to sites which:
  - (1) Have been decommissioned prior to August 20, 1997, in accordance with criteria identified in the United States nuclear regulatory commission's site decommissioning management plan action plan of April 16, 1992 (57 FR 13389);
  - (2) Have previously submitted and received department approval on a license termination plan or decommissioning plan that is compatible with the criteria identified in the United States nuclear regulatory commission's site decommissioning management plan action plan of April 16, 1992 (57 FR 13389); or
  - (3) Submit a sufficient license termination plan or decommissioning plan before August 20, 1998, and such license termination plan or decommissioning plan is approved by the department before August 20, 1999, and in accordance with the criteria identified in the United States nuclear regulatory commission's site decommissioning management plan action plan of April 16, 1992 (57 FR 13389), except that if an environmental impact statement is required in the submittal, there will be a provision for day-to-day extension.
- c. After a site has been decommissioned and the license terminated in accordance with the criteria in this section, the department will require additional cleanup only if, based on new information, it determines that the criteria of this section were not met and residual radioactivity remaining at the site could result in significant threat to public health and safety.
- d. When calculating total effective dose equivalent to the average member of the critical group, the licensee shall determine the peak

annual total effective dose equivalent dose expected within the first one thousand years after decommissioning.

2. **Radiological criteria for unrestricted use.** A site will be considered acceptable for unrestricted use if the residual radioactivity that is distinguishable from background radiation results in a total effective dose equivalent to an average member of the critical group that does not exceed twenty-five hundredths millisievert [25 millirem] per year, including that from ground water sources of drinking water, and the residual radioactivity has been reduced to levels that are as low as reasonably achievable. Determination of the levels which are as low as reasonably achievable shall take into account consideration of any detriments, such as deaths from transportation accidents, expected to potentially result from decontamination and waste disposal.
3. **Criteria for license termination under restricted conditions.** A site will be considered acceptable for license termination under restricted conditions if:
  - a. The licensee can demonstrate that further reductions in residual radioactivity necessary to comply with the provisions of subsection 2 would result in net public or environmental harm or were not being made because the residual levels associated with restricted conditions are as low as reasonably achievable. Determination of the levels which are as low as reasonably achievable shall take into account consideration of any detriments, such as traffic accidents, expected to potentially result from decontamination and waste disposal;
  - b. The licensee has made provisions for legally enforceable institutional controls that provide reasonable assurance that the total effective dose equivalent from residual radioactivity distinguishable from background to the average member of the critical group will not exceed twenty-five hundredths millisievert [25 millirem] per year;
  - c. The licensee has provided sufficient financial assurance to enable an independent third party, including a governmental custodian of a site, to assume and carry out responsibilities for any necessary control and maintenance of the site. Acceptable financial assurance mechanisms are:
    - (1) Funds placed into an account segregated from the licensee's assets and outside the licensee's administrative control as described in chapter 33-10-03;
    - (2) Surety method, insurance, or other guarantee method as described in chapter 33-10-03;

- (3) A statement of intent in the case of federal, state, or local government licensees, as described in chapter 33-10-03; or
  - (4) When a governmental entity is assuming custody and ownership of a site, an arrangement that is deemed acceptable by such governmental entity;
- d. The licensee has submitted a decommissioning plan or license termination plan to the department indicating the licensee's intent to decommission in accordance with chapter 33-10-03, and specifying that the licensee intends to decommission by restricting use of the site. The licensee shall document in the license termination plan or decommissioning plan how the advice of individuals and institutions in the community who may be affected by the decommissioning has been sought and incorporated, as appropriate, following analysis of that advice.
- (1) Licensees proposing to decommission by restricting use of the site shall seek advice from such affected parties regarding the following matters concerning the proposed decommissioning:
    - (a) Whether provisions for institutional controls proposed by the licensee:
      - [1] Will provide reasonable assurance that the total effective dose equivalent from residual radioactivity distinguishable from background to the average member of the critical group will not exceed twenty-five hundredths millisievert [25 millirems] total effective dose equivalent per year;
      - [2] Will be enforceable; and
      - [3] Will not impose undue burdens on the local community or other affected parties; and
    - (b) Whether the licensee has provided sufficient financial assurance to enable an independent third party, including a governmental custodian of a site, to assume and carry out responsibilities for any necessary control and maintenance of the site; and
  - (2) In seeking advice on the issues identified in paragraph 1, the licensee shall provide for:

- (a) Participation by representatives of a broad cross section of community interests who may be affected by the decommissioning;
  - (b) An opportunity for a comprehensive, collective discussion on the issues by the participants represented; and
  - (c) A publicly available summary of the results of all such discussions, including a description of the individual viewpoints of the participants on the issues and the extent of agreement and disagreement among the participants on the issues; and
- e. Residual radioactivity at the site has been reduced so that if the institutional controls were no longer in effect, there is reasonable assurance that the total effective dose equivalent from residual radioactivity distinguishable from background to the average member of the critical group is as low as reasonably achievable and would not exceed either:
  - (1) One millisievert [100 millirems] per year; or
  - (2) Five millisieverts [500 millirems] per year provided the licensee:
    - (a) Demonstrates that further reductions in residual radioactivity necessary to comply with the one millisievert [100 millirems] per year value of paragraph 1 are not technically achievable, would be prohibitively expensive, or would result in net public or environmental harm;
    - (b) Makes provisions for durable institutional controls; and
    - (c) Provides sufficient financial assurance to enable a responsible government entity or independent third party, including a governmental custodian of a site, both to carry out periodic rechecks of the site no less frequently than every five years to assure that the institutional controls remain in place as necessary to meet the criteria of subdivision b and to assume and carry out responsibilities for any necessary control and maintenance of those controls. Acceptable financial assurance mechanisms are those in subdivision c.

**4. Alternate criteria for license termination.**

- a. The department may terminate a license using alternate criteria greater than the dose criterion of subsection 2, subdivision b of subsection 3, or item 1 of subparagraph a of paragraph 1 of subdivision d of subsection 3, if the licensee:
  - (1) Provides assurance that public health and safety would continue to be protected, and that it is unlikely that the total dose from all manmade sources combined, other than medical, would be more than the one millisievert [100 millirem] per year limit of section 33-10-04.1-07, by submitting an analysis of possible sources of exposure;
  - (2) Has employed to the extent practical restrictions on site use according to the provisions of subsection 3 in minimizing exposures at the site;
  - (3) Reduced doses to as low as is reasonably achievable levels taking into consideration any detriments, such as traffic accidents, expected to potentially result from decontamination and waste disposal;
  - (4) Has submitted a decommissioning plan or license termination plan to the department indicating the licensee's intent to decommission in accordance with subsection 8 of section 33-10-03-05 and specifying that the licensee proposes to decommission by use of alternate criteria. The licensee shall document in the decommissioning plan or the license termination plan how the advice of individuals and institutions in the community who may be affected by the decommissioning has been sought and incorporated, as appropriate, following analysis of that advice. In seeking such advice, the licensee shall provide for:
    - (a) Participation by representatives of a broad cross section of community interests who may be affected by the decommissioning;
    - (b) An opportunity for a comprehensive, collective discussion on the issues by the participants represented; and
    - (c) A publicly available summary of the results of all such discussions, including a description of the individual viewpoints of the participants on the issues and the extent of agreement and disagreement among the participants on the issues.
- b. The use of alternate criteria to terminate a license requires the approval of the department after addressing any comments

provided by the United States environmental protection agency, the United States nuclear regulatory commission, and any public comments submitted pursuant to subsection 5.

5. **Public notification and public participation.** Upon the receipt of a license termination plan or decommissioning plan from the licensee, or a proposal by the licensee for release of a site pursuant to subsection 3 or 4, or whenever the department deems such notice to be in the public interest, the department shall provide opportunity for public comment. Public comment procedures shall include the following:
- a. Notice shall be given by publication in a newspaper of general circulation in the area where the license is located or in a state publication designed to give public notice; to persons on a mailing list developed by the department, including those who request in writing to be on the list; and by other means if necessary to assure adequate notice of the affected public. This shall include publishing a notice in a forum, such as local newspapers, letters to state or local organizations, or other appropriate forum, that is readily accessible to individuals in the vicinity of the site, and soliciting comments from affected parties;
  - b. Notice shall be made to, and comments solicited from, the United States environmental protection agency and United States nuclear regulatory commission for cases where the licensee proposes to release a site pursuant to subsection 4;
  - c. Notice shall be made to, and comments solicited from, local and state governments in the vicinity of the site and any Indian nation or other indigenous people that have treaty or statutory rights that could be affected by the decommissioning;
  - d. The notice shall identify the affected facility; the name and address of the licensee; the name and address of the department; a brief description of the plan; the name, address, and telephone number of a person from whom interested persons may obtain additional information, including copies of the plan, all relevant supporting materials, and all other materials available to the department that are relevant to the decision; a brief description of the comment procedures required by this subsection; and the time and place of any hearing that may be held, including a statement of procedures to request a hearing, unless a hearing has already been scheduled;
  - e. The department shall provide at least thirty days for public comment and shall give notice of any public hearing at least thirty days in advance of the hearing; and

- f. The department shall keep a record of the commenters and also of the issues raised during the public participation process. These records shall be available to the public.
- 6. **Minimization of contamination.** Applicants for licenses, other than renewals, shall describe in the application how facility design and procedures for operation will minimize, to the extent practicable, contamination of the facility and the environment, facilitate eventual decommissioning, and minimize, to the extent practicable, the generation of radioactive waste.

**History:** Effective May 1, 1998; amended effective March 1, 2003.

**General Authority:** NDCC 23-20.1-04

**Law Implemented:** NDCC 23-20.1-03, 23-20.1-04, 23-20.1-04.1

## APPENDIX A

### ASSIGNED PROTECTION FACTORS FOR RESPIRATORS<sup>1</sup>

		Assigned Protection Factors	
Description	Modes <sup>3</sup>	Particulates only	Particulates, gases & vapors
(1) AIR-PURIFYING RESPIRATORS <sup>6</sup>			
Filtering facepiece <sup>4</sup> disposable	NP	4	
Facepiece, half <sup>7</sup>	NP	10	
Facepiece, full	NP	100	
Facepiece, half	PP	50	
Facepiece, full	PP	1000	
Helmet or hood	PP	1000	
Facepiece, loose-fitting	PP	25	
(2) ATMOSPHERE-SUPPLYING RESPIRATORS <sup>5</sup>			
1. Air-line respirator			
Facepiece, half	CF		50
Facepiece, half	D		10
Facepiece, half	PD		50
Facepiece, full	CF		1000
Facepiece, full	D		100
Facepiece, full	PD		1000
Helmet or hood	CF		1000
Facepiece, loose-fitting	CF		25
Suit	CF		2
2. Self-contained breathing apparatus (SCBA)			
Facepiece, full	D		100 <sup>9</sup>
Facepiece, full	PD		10,000 <sup>8</sup>
Facepiece, full	RD		100 <sup>9</sup>
Facepiece, full	RP		10,000 <sup>8</sup>
3. COMBINATION RESPIRATORS		Assigned protection factor for type and mode of operation as listed above.	
Any combination of air-purifying and atmosphere-supplying respirators			

### FOOTNOTES

1. These assigned protection factors apply only in a respiratory protection program that meets the requirements of this chapter. They are

applicable only to airborne radiological hazards and may not be appropriate to circumstances when chemical or other respiratory hazards exist instead of, or in addition to, radioactive hazards. Selection and use of respirators for such circumstances must also comply with United States Department of Labor regulations.

Radioactive contaminants for which the concentration values in Table 1, Column 3 of Appendix B of Chapter 33-10-04.1 are based on internal dose due to inhalation may, in addition, present external exposure hazards at higher concentrations. Under these circumstances, limitations on occupancy may have to be governed by external dose limits.

2. No NIOSH approval schedule is currently available for atmosphere supplying suits. This equipment may be used in an acceptable respiratory protection program as long as all the other minimum program requirements in section 33-10-04.1-11, with the exception of fit testing, are met.
3. The mode symbols are defined as follows:  
  
CF = continuous flow  
D = demand  
NP = negative pressure, that is, negative phase during inhalation  
PD = pressure demand, that is, always positive pressure  
PP = powered air-purifying  
RD = demand, recirculating  
RP = positive pressure, recirculating
4. Licensees may permit individuals to use this type of respirator who have not been medically screened or fit tested on the device provided that no credit be taken for their use in estimating intake or dose. It is also recognized that it is difficult to perform an effective positive or negative pressure pre-use user seal check on this type of device. All other respiratory protection program requirements listed in subsection 3 of section 33-10-04.1-11 apply. An assigned protection factor has not been assigned for these devices. However, an assigned protection factor equal to 10 may be used if the licensee can demonstrate a fit factor of at least 100 by use of a validated or evaluated, qualitative or quantitative fit test.
5. The assigned protection factors for gases and vapors are not applicable to radioactive contaminants that present an absorption or submersion hazard. For tritium oxide vapor, approximately one-third of the intake occurs by absorption through the skin so that an overall protection factor of three is appropriate when atmosphere-supplying respirators are used to protect against tritium oxide. Exposure to radioactive noble gases is

not considered a significant respiratory hazard, and protective actions for these contaminants should be based on external (submersion) dose considerations.

6. Canisters and cartridges shall not be used beyond service-life limitations. Air purifying respirators with assigned protection factors <100 must be equipped with particulate filters that are at least 95 percent efficient. Air purifying respirators with APF = 100 must be equipped with particulate filters that are at least 99 percent efficient. Air purifying respirators with assigned protection factors >100 must be equipped with particulate filters that are at least 99.97 percent efficient. The licensee may apply to the department for the use of an assigned protection factor greater than 1 for sorbent cartridges as protection against airborne radioactive gases and vapors (e.g., radioiodine).
7. Under-chin type only. No distinction is made in this appendix between elastomeric half-masks with replaceable cartridges and those designed with the filter medium as an integral part of the facepiece (e.g., disposable or reusable disposable). Both types are acceptable so long as the seal area of the latter contains some substantial type of seal-enhancing material such as rubber or plastic, the two or more suspension straps are adjustable, the filter medium is at least 95 percent efficient and all other requirements of this chapter are met.
8. This type of respirator may be used as an emergency device in unknown concentrations for protection against inhalation hazards. External radiation hazards and other limitations to permitted exposure, such as skin absorption, must be taken into account in such circumstances. This device may not be used by any individual who experiences perceptible outward leakage of breathing gas while wearing the device.
9. The licensee should implement institutional controls to assure that these devices are not used in areas immediately dangerous to life or health (IDLH).

**APPENDIX B**  
**ANNUAL LIMITS ON INTAKE (ALI) AND DERIVED AIR CONCENTRATIONS**  
**(DAC) OF RADIONUCLIDES FOR OCCUPATIONAL EXPOSURE; EFFLUENT**  
**CONCENTRATIONS; CONCENTRATIONS FOR RELEASE TO SANITARY**  
**SEWERAGE**

Introduction

For each radionuclide, table I indicates the chemical form which is to be used for selecting the appropriate annual limit on intake or derived air concentration value. The annual limit on intakes and derived air concentrations for inhalation are given for an aerosol with an activity median aerodynamic diameter (AMAD) of one  $\mu\text{m}$ , micron, and for three classes (D,W,Y) of radioactive material, which refer to their retention (approximately days, weeks or years) in the pulmonary region of the lung. This classification applies to a range of clearance half-times of less than ten days for D, from ten to one hundred days for W, and of greater than one hundred days for Y. The class (D, W, Y) given in the column headed "class" applies only to the inhalation annual limit on intakes and derived air concentrations given in table I columns 2 and 3. Table II provides concentration limits for airborne and liquid effluents released to the general environment. Table III provides concentration limits for discharges to sanitary sewerage.

Note:

The values in tables I, II, and III are presented in the computer "E" notation. In this notation a value of 6E-02 represents a value of  $6 \times 10^{-2}$  or six hundredths, 6E+2 represents  $6 \times 10^2$  or six hundred, and 6E+0 represents  $6 \times 10^0$  or six.

Table I "Occupational Values"

Note that the columns in table I of this appendix captioned "oral ingestion annual limit on intake," "inhalation annual limit on intake," and "derived air concentration," are applicable to occupational exposure to radioactive material.

The annual limit on intakes in this appendix are the annual intakes of given radionuclide by "reference man" which would result in either (1) a committed effective dose equivalent of five hundredths sieverts (five rem), stochastic annual limit on intake, or (2) a committed dose equivalent of five tenths sieverts (fifty rem) to an organ or tissue, nonstochastic annual limit on intake. The stochastic annual limit on intakes were derived to result in a risk, due to irradiation of organs and tissues, comparable to the risk associated with deep dose equivalent to the whole body of five hundredths sieverts (five rem). The derivation includes multiplying the committed dose equivalent to an organ or tissue by a weighting factor,  $W_T$ . This weighting factor is the proportion of the risk of stochastic effects resulting from irradiation of the organ or tissue, T, to the total risk of stochastic effects when the whole body is irradiated uniformly. The values of  $W_T$  are listed under the definition of weighting factor in section 33-10-04.1-03. The nonstochastic annual limit on intakes were derived to avoid nonstochastic effects, such as prompt damage to tissue or reduction in organ function.

A value of  $W_T = 0.06$  is applicable to each of the five organs or tissues in the "remainder" category receiving the highest dose equivalents, and the dose equivalents of all other remaining tissues may be disregarded. The following portions of the gastro-intestinal tract -- stomach, small intestine, upper large intestine, and lower large intestine -- are to be treated as four separate organs.

Note that the dose equivalents for an extremity (hands and forearms, feet, and lower legs), skin, and lens of the eye are not considered in computing the committed effective dose equivalent, but are subject to limits that must be met separately.

When an annual limit on intake is defined by the stochastic dose limit, this value alone is given. When an annual limit on intake is determined by the nonstochastic dose limit to an organ, the organ or tissue to which the limit applies is shown, and the annual limit on intake for the stochastic limit is shown in parentheses. Abbreviated organ or tissue designations are used:

LLI wall = lower large intestine wall;

St wall = stomach wall;

Blad wall = bladder wall; and

Bone surf = bone surface.

The use of the annual limit on intakes listed first, the more limiting of the stochastic and nonstochastic annual limit on intakes, will ensure that nonstochastic effects are avoided and that the risk of stochastic effects is limited to an acceptably low value. If, in a particular situation involving a radionuclide for which the nonstochastic annual limit on intake is limiting, use of that nonstochastic annual limit on intake is considered unduly conservative, the licensee may use the stochastic annual limit on intake to determine the committed effective dose equivalent. However, the licensee shall also ensure that the five tenths sievert (fifty rem) dose equivalent limit for any organ or tissue is not exceeded by the sum of the external deep dose equivalent plus the internal committed dose equivalent to that organ, not the effective dose. For the case where there is no external dose contribution, this would be demonstrated if the sum of the fractions of the nonstochastic annual limit on intakes ( $ALI_{ns}$ ) that contribute to the committed dose equivalent to the organ receiving the highest dose does not exceed unity, that is,  $\Sigma (\text{intake (in } \mu\text{Ci) of each radionuclide} / ALI_{ns}) \leq \text{one}$ . If there is an external deep dose equivalent contribution of  $H_d$ , then this sum must be less than  $1 - (H_d/50)$ , instead of  $\leq \text{one}$ .

The derived air concentration (DAC) values are derived limits intended to control chronic occupational exposures. The relationship between the derived air concentration and the annual limit on intake is given by:

$$\text{DAC} = \text{ALI (in } \mu\text{Ci}) / (2000 \text{ hours per working year} \times 60 \text{ minutes/hour} \times 2 \times 10^4 \text{ ml per minute}) = [\text{ALI} / 2.4 \times 10^9] \mu\text{Ci/ml},$$

where  $2 \times 10^4$  ml is the volume of air breathed per minute at work by reference man under working conditions light work.

The derived air concentration values relate to one of two modes of exposure: either external submersion or the internal committed dose equivalents resulting from inhalation of radioactive materials. Derived air concentrations based upon submersion are for immersion in a semi-infinite cloud of uniform concentration and apply to each radionuclide separately.

The annual limit on intake and derived air concentration values include contributions to exposure by the single radionuclide named and any in-growth of daughter radionuclides produced in the body by decay of the parent. However, intakes that include both the parent and daughter radionuclides should be treated by the general method appropriate for mixtures.

The values of annual limit on intake and derived air concentration do not apply directly when the individual both ingests and inhales a radionuclide, when the individual is exposed to a mixture of radionuclides by either inhalation or ingestion or both, or when the individual is exposed to both internal and external irradiation. See subsection 2 of section 33-10-04.1-06. When an individual is exposed to radioactive materials which fall under several of the translocation classifications of the same radionuclide, such as, class D, class W, or class Y, the exposure may be evaluated as if it were a mixture of different radionuclides.

It should be noted that the classification of a compound as class D, W, or Y is based on the chemical form of the compound and does not take into account the radiological half-life of different radionuclides. For this reason, values are given for class D, W, and Y compounds, even for very short-lived radionuclides.

Table II "Effluent Concentrations"

The columns in table II of this appendix captioned "effluent concentrations," "air" and "water" are applicable to the assessment and control of dose to the public, particularly in the implementation of the provisions of subsection 2 of section 33-10-04.1-07. The concentration values given in columns 1 and 2 of table II are equivalent to the radionuclide concentrations which, if inhaled or ingested continuously over the course of a year, would produce a total effective dose equivalent of five tenths millisievert (0.05 rem).

Consideration of nonstochastic limits has not been included in deriving the air and water effluent concentration limits because nonstochastic effects are presumed not to occur at or below the dose levels established for individual members of the public. For radionuclides, where the nonstochastic limit was governing in deriving the occupational derived air concentration, the stochastic annual limit on intake was used in deriving the corresponding airborne effluent limit in table II. For this reason, the derived air concentration and airborne effluent limits

are not always proportional as was the case in appendix A of the 1992 revision of chapter 33-10-04.1.

The air concentration values listed in table II, column 1 were derived by one of two methods. For those radionuclides for which the stochastic limit is governing, the occupational stochastic inhalation annual limit on intake was divided by  $2.4 \times 10^9$  (ml), relating the inhalation annual limit on intake to the derived air concentration, as explained above, and then divided by a factor of three hundred. The factor of three hundred includes the following components: a factor of fifty to relate the five hundredths sievert (5 rem) annual occupational dose limit to the one millisievert (0.1 rem) limit for members of the public, a factor of three to adjust for the difference in exposure time and the inhalation rate for a worker and that for members of the public; and a factor of two to adjust the occupational values, derived for adults, so that they are applicable to other age groups.

For those radionuclides for which submersion, that is external dose, is limiting, the occupational derived air concentration in table I, column 3 was divided by two hundred nineteen. The factor of two hundred nineteen is composed of a factor of fifty, as described above, and a factor of four and thirty-eight hundredths relating occupational exposure for two thousand hours per year to full-time exposure (8,760 hours per year). Note that an additional factor of two for age considerations is not warranted in the submersion case.

The water concentrations were derived by taking the most restrictive occupational stochastic oral ingestion annual limit on intake and dividing by  $7.3 \times 10^7$ . The factor of  $7.3 \times 10^7$  (ml) includes the following components: the factors of fifty and two described above and a factor of  $7.3 \times 10^5$  (ml) which is the annual water intake of reference man.

Note 2 of this appendix provides groupings of radionuclides which are applicable to unknown mixtures of radionuclides. These groupings, including occupational inhalation annual limit on intakes and derived air concentrations, air and water effluent concentrations and releases to sewer, require demonstrating that the most limiting radionuclides in successive classes are absent. The limit for the unknown mixture is defined when the presence of one of the listed radionuclides cannot be definitely excluded either from knowledge of the radionuclide composition of the source or from actual measurements.

#### Table III "Releases to Sewers"

The monthly average concentrations for release to sanitary sewerage are applicable to the provisions in subsection 3 of section 33-10-04.1-14. The concentration values were derived by taking the most restrictive occupational stochastic oral ingestion annual limit on intake and dividing by  $7.3 \times 10^6$  (ml). The factor of  $7.3 \times 10^6$  (ml) is composed of a factor of  $7.3 \times 10^5$  (ml), the annual water intake by reference man, and a factor of 10, such that the concentrations, if the sewage released by the licensee were the only source of water ingested by a reference man during a year, would result in a committed effective dose equivalent of five millisieverts (0.5 rem).

# LIST OF ELEMENTS

<u>Name</u>	<u>Symbol</u>	<u>Atomic Number</u>	<u>Name</u>	<u>Symbol</u>	<u>Atomic Number</u>
Actinium	Ac	89	Mercury	Hg	80
Aluminum	Al	13	Molybdenum	Mo	42
Americium	Am	95	Neodymium	Nd	60
Anitimony	Sb	51	Neptunium	Np	93
Argon	Ar	18	Nickel	Ni	28
Arsenic	As	33	Niobium	Nb	41
Astatine	At	85	Osmium	Os	76
Barium	Ba	56	Palladium	Pd	46
Berkelium	Bk	97	Phosphorus	P	15
Beryllium	Be	4	Platinum	Pt	78
Bismuth	Bi	83	Plutonium	Pu	94
Bromine	Br	35	Polonium	Po	84
Cadmium	Cd	48	Potassium	K	19
Calcium	Ca	20	Praseodymium	Pr	59
Californium	Cf	98	Promethium	Pm	61
Carbon	C	6	Protactinium	Pa	91
Cerium	Ce	58	Radium	Ra	88
Cesium	Cs	55	Radon	Rn	86
Chlorine	Cl	17	Rhenium	Re	75
Chromium	Cr	24	Rhodium	Rh	45
Cobalt	Co	27	Rubidium	Rb	37
Copper	Cu	29	Ruthenium	Ru	44
Curium	Cm	96	Samarium	Sm	62
Dysprosium	Dy	66	Scandium	Sc	21
Einsteinium	Es	99	Selenium	Se	34
Erbium	Er	68	Silicon	Si	14
Europium	Eu	63	Silver	Ag	47
Fermium	Fm	100	Sodium	Na	11
Fluorine	F	9	Strontium	Sr	38
Francium	Fr	87	Sulfur	S	16
Gadolinium	Gd	64	Tantalum	Ta	73
Gallium	Ga	31	Technetium	Tc	43

<u>Name</u>	<u>Symbol</u>	<u>Atomic Number</u>	<u>Name</u>	<u>Symbol</u>	<u>Atomic Number</u>
Germanium	Ge	32	Tellurium	Te	52
Gold	Au	79	Terbium	Tb	65
Hafnium	Hf	72	Thalium	Tl	81
Holmium	Ho	67	Thorium	Th	90
Hydrogen	H	1	Thulium	Tm	69
Indium	In	49	Tin	Sn	50
Iodine	I	53	Titanium	Ti	22
Iridium	Ir	77	Tungsten	W	74
Iron	Fe	26	Uranium	U	92
Krypton	Kr	36	Vanadium	V	23
Lanthanum	La	57	Xenon	Xe	54
Lead	Pb	82	Ytterbium	Yb	70
Lutetium	Lu	71	Yttrium	Y	39
Magnesium	Mg	12	Zinc	Zn	30
Manganese	Mn	25	Zirconium	Zr	40
Mendelevium	Md	101			

## TABLE I AND APPENDIX C

**Table I** cannot be accurately reproduced for publication. Users should contact the State Department of Health to obtain a correct copy.

**Appendix C** cannot be accurately reproduced for publication. Users should contact the State Department of Health to obtain a correct copy.

**APPENDIX D**  
**[Reserved]**

## **APPENDIX E**

### **CLASSIFICATION AND CHARACTERISTICS OF LOW-LEVEL RADIOACTIVE WASTE**

1. Classification of radioactive waste for land disposal.
  - a. Considerations. Determination of the classification of radioactive waste involves two considerations. First, consideration must be given to the concentration of long-lived radionuclides (and their shorter-lived precursors) whose potential hazard will persist long after such precautions as institutional controls, improved waste form, and deeper disposal have ceased to be effective. These precautions delay the time when long-lived radionuclides could cause exposures. In addition, the magnitude of the potential dose is limited by the concentration and availability of the radionuclide at the time of exposure. Second, consideration must be given to the concentration of shorter-lived radionuclides for which requirements on institutional controls, waste form, and disposal methods are effective.
  - b. Classes of waste.
    - (1) Class A waste is waste that is usually segregated from other waste classes at the disposal site. The physical form and characteristics of class A waste must meet the minimum requirements set forth in subdivision a of subsection 2. If class A waste also meets the stability requirements set forth in subdivision b of subsection 2, it is not necessary to segregate the waste for disposal.
    - (2) Class B waste is waste that must meet more rigorous requirements on waste form to ensure stability after disposal. The physical form and characteristics of class B waste must meet both the minimum and stability requirements set forth in subsection 2.
    - (3) Class C waste is waste that not only must meet more rigorous requirements on waste form to ensure stability but also requires additional measures at the disposal facility to protect against inadvertent intrusion. The physical form and characteristics of class C waste must meet both the minimum and stability requirements set forth in subsection 2.
  - c. Classification determined by long-lived radionuclides. If the radioactive waste contains only radionuclides listed in table I, classification shall be determined as follows:

- (1) If the concentration does not exceed one-tenth times the value in table I, the waste is class A.
- (2) If the concentration exceeds one-tenth times the value in table I, but does not exceed the value in table I, the waste is class C.
- (3) If the concentration exceeds the value in table I, the waste is not generally acceptable for land disposal.
- (4) For wastes containing mixtures of radionuclides listed in table I, the total concentrations shall be determined by the sum of fractions rule described in subdivision g.

TABLE I

Radionuclide	Concentration curie/cubic meter <sup>a</sup>	Concentration nanocurie/gram <sup>b</sup>
C-14	8	
C-14 in activated metal	80	
Ni-59 in activated metal	220	
Nb-94 in activated metal	0.2	
Tc-99	3	
I-129	0.08	
Alpha emitting transuranic radionuclides with half-life greater than five years		100
Pu-241		3,500
Cm-242		20,000
Ra-226		100

<sup>a</sup> To convert the curie per cubic meter values to gigabecquerel per cubic meter, multiply the curie per cubic meter value by thirty-seven.

<sup>b</sup> To convert the nanocurie per gram values to becquerel per gram, multiply the nanocurie per gram value by thirty-seven.

- d. Classification determined by short-lived radionuclides. If the waste does not contain any of the radionuclides listed in table I, classification shall be determined based on the concentrations shown in table II. However, as specified in subdivision f, if

radioactive waste does not contain any nuclides listed in either table I or II, it is a class A.

- (1) If the concentration does not exceed the value in column 1, the waste is class A.
- (2) If the concentration exceeds the value in column 1 but does not exceed the value in column 2, the waste is class B.
- (3) If the concentration exceeds the value in column 2 but does not exceed the value in column 3, the waste is class C.
- (4) If the concentration exceeds the value in column 3, the waste is not generally acceptable for near-surface disposal.
- (5) For wastes containing mixtures of the radionuclides listed in table II, the total concentration shall be determined by the sum of fractions rule described in subdivision g.

TABLE II

Radionuclide	Concentration, curie per cubic meter*		
	Column 1	Column 2	Column 3
Total of all radionuclides with less than 5-year half-life	700	*	*
H-3	40	*	*
Co-60	700	*	*
Ni-63	3.5	70	700
Ni-63 in activated metal	35	700	7000
Sr-90	0.04	150	7000
Cs-137	1	44	4600

\* To convert the curie per cubic meter value to gigabecquerel per cubic meter, multiply the curie per cubic meter value by thirty-seven. There are no limits established for these radionuclides in class B or class C wastes. Practical considerations such as the effects of external radiation and internal heat generation on transportation, handling, and disposal will limit the concentrations for these wastes. These wastes shall be class B unless the concentrations of other radionuclides in table II determine the waste to be class C independent of these radionuclides.

- e. Classification determined by both long-lived and short-lived radionuclides. If the radioactive waste contains a mixture of radionuclides, some of which are listed in table I and some of

which are listed in table II, classification shall be determined as follows:

- (1) If the concentration of a radionuclide listed in table I is less than one-tenth times the value listed in table I, the class shall be that determined by the concentration of radionuclides listed in table II.
  - (2) If the concentration of a radionuclide listed in table I exceeds one-tenth times the value listed in table I, but does not exceed the value in table I the waste shall be class C, provided the concentration of radionuclides listed in table II does not exceed the value shown in column 3 of table II.
- f. Classification of wastes with radionuclides other than those listed in tables I and II. If the waste does not contain any radionuclides listed in either table I or II, it is class A.
9. The sum of the fractions rule for mixtures of radionuclides. For determining classification for waste that contains a mixture of radionuclides, it is necessary to determine the sum of fractions by dividing each radionuclide's concentration by the appropriate limit and adding the resulting values. The appropriate limits must all be taken from the same column of the same table. The sum of the fractions for the column must be less than one if the waste class is to be determined by that column. Example: A waste contains strontium-90 in a concentration of one and eighty-five-hundredths terabecquerels per cubic meter ( $50 \text{ Ci/M}^3$ ) and cesium-137 in a concentration of eight hundred fourteen gigabecquerels per cubic meter ( $22 \text{ Ci/m}^3$ ). Since the concentrations both exceed the values in column 1, table II, they must be compared to column 2 values. For strontium-90 fraction, fifty divided by one hundred fifty is one-third, for cesium-137 fraction, twenty-two divided by forty-four is one-half; the sum of the fractions is eighty-three hundredths. Since the sum is less than one, the waste is class B.
- h. Determination of concentrations in wastes. The concentration of a radionuclide may be determined by indirect methods such as use of scaling factors which relate the inferred concentration of one radionuclide to another that is measured, or radionuclide material accountability if there is reasonable assurance that the indirect methods can be correlated with actual measurements. The concentration of a radionuclide may be averaged over the volume of the waste, or weight of the waste if the units are expressed as becquerel (nanocurie) per gram.

## 2. Radioactive waste characteristics.

- a. The following are minimum requirements for all classes of waste and are intended to facilitate handling and provide protection of health and safety of personnel at the disposal site.
- (1) Wastes shall be packaged in conformance with the conditions of the license issued to the site operator to which the waste will be shipped. Where the conditions of the site license are more restrictive than the provisions of chapter 33-10-04.1, the site license conditions shall govern.
  - (2) Wastes shall not be packaged for disposal in cardboard or fiberboard boxes.
  - (3) Liquid waste shall be packaged in sufficient absorbent material to absorb twice the volume of the liquid.
  - (4) Solid waste containing liquid shall contain as little freestanding and noncorrosive liquid as is reasonably achievable, but in no case shall the liquid exceed one percent of the volume.
  - (5) Waste shall not be readily capable of detonation or of explosive decomposition or reaction at normal pressures and temperatures, or of explosive reaction with water.
  - (6) Waste shall not contain, or be capable of generating, quantities of toxic gases, vapors, or fumes harmful to persons transporting, handling, or disposing of the waste. This does not apply to radioactive gaseous waste packaged in accordance with paragraph 8.
  - (7) Waste must not be pyrophoric material. Pyrophoric materials contained in wastes shall be treated, prepared, and packaged to be nonflammable. (See section 33-10-01-04 for the definition of pyrophoric.)
  - (8) Wastes in a gaseous form shall be packaged at an absolute pressure that does not exceed one and one-half atmospheres at twenty degrees Celsius. Total activity shall not exceed three and seven-tenths terabecquerels (100 Ci) per container.
  - (9) Wastes containing hazardous, biological, pathogenic, or infectious material shall be treated or reduced to the maximum extent practicable the potential hazard from the nonradiological materials.
- b. The following requirements are intended to provide stability of the waste. Stability is intended to ensure that the waste does not

degrade and affect overall stability of the site through slumping, collapse, or other failure of the disposal unit and thereby lead to water infiltration. Stability is also a factor in limiting exposure to an inadvertent intruder, since it provides a recognizable and nondispersible waste.

- (1) Waste shall have structural stability. A structurally stable waste form will generally maintain its physical dimensions and its form, under the expected disposal conditions such as weight of overburden and compaction equipment, the presence of moisture, and microbial activity, and internal factors such as radiation effects and chemical changes. Structural stability can be provided by the waste form itself, processing the waste to a stable form, or placing the waste in a disposal container or structure that provides stability after disposal.
  - (2) Notwithstanding the provisions in paragraphs 3 and 4 of subdivision a of subsection 2, liquid wastes, or wastes containing liquid, shall be converted into a form that contains as little freestanding and noncorrosive liquid as is reasonably achievable, but in no case shall the liquid exceed one percent of the volume of the waste when the waste is in a disposal container designed to ensure stability, or 0.5 percent of the volume of the waste for waste processed to a stable form.
  - (3) Void spaces within the waste and between the waste and its package shall be reduced to the extent practicable.
3. Labeling. Each package of waste shall be clearly labeled to identify whether it is class A, class B, or class C waste, in accordance with subsection 1.

## APPENDIX F

### Standards for Unrestricted Areas

(a) Surface contamination limits

(1) Alpha emitters

(i)	Removable:	$\frac{0.555 \text{ Bq}}{100 \text{ cm}^2} =$	$\frac{15 \text{ pCi}}{100 \text{ cm}^2}$	$= \frac{33 \text{ dpm}}{100 \text{ cm}^2}$	average over any one surface
		$\frac{1.665 \text{ Bq}}{100 \text{ cm}^2} =$	$\frac{45 \text{ pCi}}{100 \text{ cm}^2}$	$= \frac{100 \text{ dpm}}{100 \text{ cm}^2}$	maximum
(ii)	Total (fixed):	$\frac{166.5 \text{ Bq}}{100 \text{ cm}^2} =$	$\frac{450 \text{ pCi}}{100 \text{ cm}^2}$	$= \frac{1000 \text{ dpm}}{100 \text{ cm}^2}$	average over any one surface
		$\frac{832.5 \text{ Bq}}{100 \text{ cm}^2} =$	$\frac{2250 \text{ pCi}}{100 \text{ cm}^2}$	$= \frac{5000 \text{ dpm}}{100 \text{ cm}^2}$	maximum or
		$\frac{2.5 \text{ } \mu\text{Sv}}{\text{hr}} =$	$\frac{(0.25 \text{ mrem})}{\text{hr}}$		maximum at 1 cm from surface

(2) Beta-Gamma emitters

(i)	Removable:	$\frac{3.7 \text{ Bq}}{100 \text{ cm}^2} =$	$\frac{100 \text{ pCi}}{100 \text{ cm}^2}$	average over any one surface
	(all beta-gamma emitters except hydrogen-3)	$\frac{18.5 \text{ Bq}}{100 \text{ cm}^2} =$	$\frac{500 \text{ pCi}}{100 \text{ cm}^2}$	maximum
	Removable: (hydrogen-3)	$\frac{37 \text{ Bq}}{100 \text{ cm}^2} =$	$\frac{1000 \text{ pCi}}{100 \text{ cm}^2}$	average over any one surface
		$\frac{185 \text{ Bq}}{100 \text{ cm}^2} =$	$\frac{5000 \text{ pCi}}{100 \text{ cm}^2}$	maximum
(ii)	Total (fixed):	$\frac{2.5 \text{ } \mu\text{Sv}}{\text{hr}} =$	$\frac{(0.25 \text{ mrem})}{\text{hr}}$	maximum at 1 cm from surface

(b) Concentration in air and water: Appendix B, table II of chapter 33-10-04.1.

(c) Concentrations in soil and other materials except water:

(1) Radioactive material except source material and radium: Schedule A, column II of chapter 33-10-03.

(2) Source material and radium in soil: Concentration of radionuclides above background concentrations for total radium, averaged over areas of one hundred square meters, shall not exceed:

- (i) Five picocuries per gram of dry soil, averaged over the first fifteen centimeters below the surface; and
- (ii) Five picocuries per gram of dry soil, averaged over layers of fifteen centimeters thickness more than fifteen centimeters below the surface.

(3) Source material and radium in other materials: Concentration of radionuclides above background concentrations for total radium shall not exceed five picocuries per gram.

(d) The level of gamma radiation measured at a distance of one hundred centimeters from the surface shall not exceed background.

**APPENDIX G**  
**REQUIREMENTS FOR TRANSFERS OF LOW-LEVEL**  
**RADIOACTIVE WASTE INTENDED**  
**FOR DISPOSAL AT LICENSED LAND DISPOSAL**  
**FACILITIES AND MANIFESTS**

I. Manifest.

A waste generator, collector, or processor who transports, or offers for transportation, low-level radioactive waste intended for ultimate disposal at a licensed low-level radioactive waste land disposal facility must prepare a manifest (Federal OMB Control Numbers 3150-0164, -0165, and -0166) reflecting information requested on applicable United States nuclear regulatory commission (NRC) Forms 540 (uniform low-level radioactive waste manifest (shipping paper)) and 541 (uniform low-level radioactive waste manifest (container and waste description)) and, if necessary, on an applicable NRC Form 542 (uniform low-level radioactive waste manifest (manifest index and regional compact tabulation)). Nuclear regulatory commission Forms 540 and 540A must be completed and must physically accompany the pertinent low-level waste shipment. Upon agreement between shipper and consignee, NRC Forms 541 and 541A and 542 and 542A may be completed, transmitted, and stored in electronic media with the capability for producing legible, accurate, and complete records on the respective forms. Licensees are not required by the department to comply with the manifesting requirements of chapter 33-10-04.1 when they ship:

- (a) LLW for processing and expect its return (i.e., for storage under their license) prior to disposal at a licensed land disposal facility;
- (b) LLW that is being returned to the licensee who is the "waste generator" or "generator," as defined in this appendix; or
- (c) Radioactively contaminated material to a "waste processor" that becomes the processor's "residual waste".

For guidance in completing these forms, refer to the instructions that accompany the forms. Copies of manifests required by this appendix may be legible carbon copies, photocopies, or computer printouts that reproduce the data in the format of the uniform manifest. Nuclear regulatory commission Forms 540, 540A, 541, 541A, 542 and 542A, and the accompanying instructions, in hard copy, may be obtained from the information and records management branch, office of information resources management, United States nuclear regulatory commission, Washington, D.C. 20555, telephone (301) 415-7232.

This appendix includes information requirements of the department of transportation, as codified in 49 CFR part 172. Information on hazardous, medical, or other waste, required to meet environmental protection agency regulations, as codified in 40 CFR parts 259, 261 or elsewhere, is not

addressed in this section, and must be provided on the required EPA forms. However, the required EPA forms must accompany the uniform low-level radioactive waste manifest required by this chapter.

As used in this appendix, the following definitions apply:

"Chelating agent" has the same meaning as that given in chapter 33-10-01.

"Chemical description" means a description of the principal chemical characteristics of low-level radioactive waste.

"Computer-readable medium" means that the regulatory agency's computer can transfer the information from the medium into its memory and process the data.

"Consignee" means the designated receiver of the shipment of low-level radioactive waste.

"Decontamination facility" means a facility operating under a commission or agreement state license whose principal purpose is decontamination of equipment or materials to accomplish recycle, reuse, or other waste management objectives, and, for purposes of this chapter, is not considered to be a consignee for LLW shipments.

"Disposal container" means a container principally used to confine low-level radioactive waste during disposal operations at a land disposal facility (also see "high integrity container"). Note that for some shipments, the disposal container may be the transport package.

"EPA identification number" means the number received by a transporter following application to the administrator of the environmental protection agency as required by 40 CFR part 263.

"Generator" means a licensee operating under a commission or agreement state license who (1) is a waste generator as defined in this chapter, or (2) is the licensee to whom waste can be attributed within the context of the Low-Level Radioactive Waste Policy Amendments Act of 1985 (e.g., waste generated as a result of decontamination or recycle activities).

"High integrity container (HIC)" means a container commonly designed to meet the structural stability requirements of the United States nuclear regulatory commission in 10 CFR 61.56, and to meet department of transportation requirements for a type A package.

"Land disposal facility" means the land, buildings and structures, and equipment which are intended to be used for the disposal of radioactive waste. For purposes of this chapter, a "geologic repository" as defined in 10 CFR part 60 or 63 is not considered a "land disposal facility".

Nuclear regulatory commission Forms 540, 540A, 541, 541A, 542, and 542A are official NRC Forms referenced in this appendix. Licensees need not use originals of these NRC Forms as long as any substitute forms are equivalent to the original documentation in respect to content, clarity, size, and location of information. Upon agreement between the shipper and consignee, NRC Forms 541 (and 541A) and NRC Forms 542 (and 542A) may be completed, transmitted, and stored in electronic media. The electronic media must have the capability for producing legible, accurate, and complete records in the format of the uniform manifest.

"Package" means the assembly of components necessary to ensure compliance with the packaging requirements of United States department of transportation regulations, together with its radioactive contents, as presented for transport.

"Physical description" means the items called for on NRC Form 541 to describe a low-level radioactive waste.

"Residual waste" means low-level radioactive waste resulting from processing or decontamination activities that cannot be easily separated into distinct batches attributable to specific waste generators. This waste is attributable to the processor or decontamination facility, as applicable.

"Shipper" means the licensed entity (i.e., the waste generator, waste collector, or waste processor) who offers low-level radioactive waste for transportation, typically consigning this type of waste to a licensed waste collector, waste processor, or land disposal facility operator.

"Shipping paper" means NRC Form 540 (or equivalent) and, if required, NRC Form 540A (or equivalent) which includes the information required by the department of transportation in 49 CFR part 172.

"Source material" has the same meaning as that given in chapter 33-10-01.

"Special nuclear material" has the same meaning as that given in chapter 33-10-01.

"Uniform low-level radioactive waste manifest" or "uniform manifest" means the combination of NRC Forms 540, 541, and, if necessary, 542, and their respective continuation sheets as needed, or equivalent.

"Waste collector" means an entity, operating under a commission or agreement state license, whose principal purpose is to collect and consolidate waste generated by others, and to transfer this waste, without processing or repackaging the collected waste, to another licensed waste collector, licensed waste processor, or licensed land disposal facility.

"Waste description" means the physical, chemical and radiological description of a low-level radioactive waste as called for on NRC Form 541.

"Waste generator" means an entity, operating under a commission or agreement state license, who (1) possesses any material or component that contains radioactivity or is radioactively contaminated for which the licensee foresees no further use, and (2) transfers this material or component to a licensed land disposal facility or to a licensed waste collector or processor for handling or treatment prior to disposal. A licensee performing processing or decontamination services may be a "waste generator" if the transfer of low-level radioactive waste from its facility is defined as "residual waste".

"Waste processor" means an entity, operating under a commission or agreement state license, whose principal purpose is to process, repackage, or otherwise treat low-level radioactive material or waste generated by others prior to eventual transfer of waste to a licensed low-level radioactive waste land disposal facility.

"Waste type" means a waste within a disposal container having a unique physical description (i.e., a specific waste descriptor code or description; or a waste sorbed on or solidified in a specifically defined media).

#### Information Requirements.

##### A. General Information.

The shipper of the radioactive waste, shall provide the following information on the uniform manifest:

1. The name, facility address, and telephone number of the licensee shipping the waste;
2. An explicit declaration indicating whether the shipper is acting as a waste generator, collector, processor, or a combination of these identifiers for purposes of the manifested shipment; and
3. The name, address, and telephone number, or the name and EPA identification number for the carrier transporting the waste.

##### B. Shipment Information.

The shipper of the radioactive waste shall provide the following information regarding the waste shipment on the uniform manifest:

1. The date of the waste shipment;
2. The total number of packages/disposal containers;
3. The total disposal volume and disposal weight in the shipment;
4. The total radionuclide activity in the shipment;

5. The activity of each of the radionuclides H-3, C-14, Tc-99, and I-129 contained in the shipment; and
6. The total masses of U-233, U-235, and plutonium in special nuclear material, and the total mass of uranium and thorium in source material.

C. Disposal Container and Waste Information.

The shipper of the radioactive waste shall provide the following information on the uniform manifest regarding the waste and each disposal container of waste in the shipment:

1. An alphabetic or numeric identification that uniquely identifies each disposal container in the shipment;
2. A physical description of the disposal container, including the manufacturer and model of any high integrity container;
3. The volume displaced by the disposal container;
4. The gross weight of the disposal container, including the waste;
5. For waste consigned to a disposal facility, the maximum radiation level at the surface of each disposal container;
6. A physical and chemical description of the waste;
7. The total weight percentage of chelating agent for any waste containing more than one-tenth percent chelating agent by weight, plus the identity of the principal chelating agent;
8. The approximate volume of waste within a container;
9. The sorbing or solidification media, if any, and the identity of the solidification media vendor and brand name;
10. The identities and activities of individual radionuclides contained in each container, the masses of U-233, U-235, and plutonium in special nuclear material, and the masses of uranium and thorium in source material. For discrete waste types (i.e., activated materials, contaminated equipment, mechanical filters, sealed source/devices, and wastes in solidification/stabilization media), the identities and activities of individual radionuclides associated with or contained in these waste types within a disposal container shall be reported;
11. The total radioactivity within each container; and

12. For wastes consigned to a disposal facility, the classification of the waste pursuant to 10 CFR 61.55. Waste not meeting the structural stability requirements of 10 CFR 61.56(b) must be identified.

D. Uncontainerized Waste Information.

The shipper of the radioactive waste shall provide the following information on the uniform manifest regarding a waste shipment delivered without a disposal container:

1. The approximate volume and weight of the waste;
2. A physical and chemical description of the waste;
3. The total weight percentage of chelating agent if the chelating agent exceeds one-tenth percent by weight, plus the identity of the principal chelating agent;
4. For waste consigned to a disposal facility, the classification of the waste pursuant to 10 CFR 61.55. Waste not meeting the structural stability requirements of 10 CFR 61.56(b) must be identified;
5. The identities and activities of individual radionuclides contained in the waste, the masses of U-233, U-235, and plutonium in special nuclear material, and the masses of uranium and thorium in source material; and
6. For wastes consigned to a disposal facility, the maximum radiation levels at the surface of the waste.

E. Multi-Generator Disposal Container Information.

This section applies to disposal containers enclosing mixtures of waste originating from different generators. (Note: The origin of the LLW resulting from a processor's activities may be attributable to one or more "generators" (including "waste generators") as defined in this appendix). It also applies to mixtures of wastes shipped in an uncontainerized form, for which portions of the mixture within the shipment originate from different generators.

1. For homogeneous mixtures of waste, such as incinerator ash, provide the waste description applicable to the mixture and the volume of the waste attributed to each generator.
2. For heterogeneous mixtures of waste, such as the combined products from a large compactor, identify each generator contributing waste to the disposal container, and, for discrete waste types (i.e., activated materials, contaminated equipment, mechanical filters, sealed source/devices, and wastes in

solidification/stabilization media), the identities and activities of individual radionuclides contained in these waste types within the disposal container. For each generator, provide the following:

- (a) The volume of waste within the disposal container;
- (b) A physical and chemical description of the waste, including the solidification agent, if any;
- (c) The total weight percentage of chelating agents for any disposal container containing more than one-tenth percent chelating agent by weight, plus the identity of the principal chelating agent;
- (d) The sorbing or solidification media, if any, and the identity of the solidification media vendor and brand name if the media is claimed to meet stability requirements in 10 CFR 61.56(b); and
- (e) Radionuclide identities and activities contained in the waste, the masses of U-233, U-235, and plutonium in special nuclear material, and the masses of uranium and thorium in source material if contained in the waste.

## II. Certification.

An authorized representative of the waste generator, processor, or collector shall certify by signing and dating the shipment manifest that the transported materials are properly classified, described, packaged, marked, and labeled and are in proper condition for transportation according to the applicable regulations of the department of transportation and the commission. A collector in signing the certification is certifying that nothing has been done to the collected waste which would invalidate the waste generator's certification.

## III. Control and Tracking.

- A. Any licensee who transfers radioactive waste to a land disposal facility or a licensed waste collector shall comply with the requirements in paragraphs a through i. Any licensee who transfers waste to a licensed waste processor for waste treatment or repackaging shall comply with the requirements of paragraphs d through i. A licensee shall:
  - (a) Prepare all wastes so that the waste is classified according to 10 CFR 61.55 and meets the waste characteristics requirements in 10 CFR 61.56;
  - (b) Label each disposal container (or transport package if potential radiation hazards preclude labeling of the individual disposal

container) of waste to identify whether it is class A waste, class B waste, class C waste, or greater than class C waste, in accordance with 10 CFR 61.55;

- (c) Conduct a quality assurance program to assure compliance with 10 CFR 61.55 and 10 CFR 61.56 (the program must include management evaluation of audits);
  - (d) Prepare the NRC uniform low-level radioactive waste manifest as required by this appendix;
  - (e) Forward a copy or electronically transfer the uniform low-level radioactive waste manifest to the intended consignee so that either (i) receipt of the manifest precedes the LLW shipment or (ii) the manifest is delivered to the consignee with the waste at the time the waste is transferred to the consignee. Using both (i) and (ii) is also acceptable;
  - (f) Include NRC Form 540 (and NRC Form 540A, if required) with the shipment regardless of the option chosen in paragraph e;
  - (g) Receive acknowledgment of the receipt of the shipment in the form of a signed copy of NRC Form 540;
  - (h) Retain a copy of or electronically store the uniform low-level radioactive waste manifest and documentation of acknowledgment of receipt as the record of transfer of licensed material as required by 10 CFR Parts 30, 40, and 70; and
  - (i) For any shipments or any part of a shipment for which acknowledgment of receipt has not been received within the times set forth in this appendix, conduct an investigation in accordance with item E of this portion of the appendix.
- B. Any waste collector licensee who handles only prepackaged waste shall:
- (a) Acknowledge receipt of the waste from the shipper within one week of receipt by returning a signed copy of NRC Form 540;
  - (b) Prepare a new manifest to reflect consolidated shipments that meet the requirements of this appendix. The waste collector shall ensure that, for each container of waste in the shipment, the manifest identifies the generator of that container of waste;
  - (c) Forward a copy or electronically transfer the uniform low-level radioactive waste manifest to the intended consignee so that either:

- (1) Receipt of the manifest precedes the LLW shipment; or
- (2) The manifest is delivered to the consignee with the waste at the time the waste is transferred to the consignee. Using both (1) and (2) is also acceptable;
- (d) Include NRC Form 540 (and NRC Form 540A, if required) with the shipment regardless of the option chosen in paragraph c;
- (e) Receive acknowledgment of the receipt of the shipment in the form of a signed copy of NRC Form 540;
- (f) Retain a copy of or electronically store the uniform low-level radioactive waste manifest and documentation of acknowledgment of receipt as the record of transfer of licensed material as required by 10 CFR parts 30, 40, and 70;
- (g) For any shipments or any part of a shipment for which acknowledgment of receipt has not been received within the times set forth in this appendix, conduct an investigation in accordance with item E of this portion of the appendix; and
- (h) Notify the shipper, the department, and the administrator of the nearest commission regional office when any shipment, or part of a shipment, has not arrived within sixty days after receipt of an advance manifest, unless notified by the shipper that the shipment has been canceled.

C. Any licensed waste processor who treats or repackages waste shall:

- (a) Acknowledge receipt of the waste from the shipper within one week of receipt by returning a signed copy of NRC Form 540;
- (b) Prepare a new manifest that meets the requirements of this appendix. Preparation of the new manifest reflects that the processor is responsible for meeting these requirements. For each container of waste in the shipment, the manifest shall identify the waste generators, the preprocessed waste volume, and the other information as required in item E of portion I of this appendix;
- (c) Prepare all wastes so that the waste is classified according to 10 CFR 61.55 and meets the waste characteristics requirements in 10 CFR 61.56;
- (d) Label each package of waste to identify whether it is class A waste, class B waste, or class C waste, in accordance with 10 CFR 61.55 and 10 CFR 61.57;

- (e) Conduct a quality assurance program to assure compliance with 10 CFR 61.55 and 10 CFR 61.56 (the program shall include management evaluation of audits);
- (f) Forward a copy or electronically transfer the uniform low-level radioactive waste manifest to the intended consignee so that either (i) receipt of the manifest precedes the LLW shipment or (ii) the manifest is delivered to the consignee with the waste at the time the waste is transferred to the consignee. Using both (i) and (ii) is also acceptable;
- (g) Include NRC Form 540 (and NRC Form 540A, if required) with the shipment regardless of the option chosen in paragraph f;
- (h) Receive acknowledgment of the receipt of the shipment in the form of a signed copy of NRC Form 540;
- (i) Retain a copy of or electronically store the uniform low-level radioactive waste manifest and documentation of acknowledgment of receipt as the record of transfer of licensed material as required by 10 CFR parts 30, 40, and 70;
- (j) For any shipment or any part of a shipment for which acknowledgment of receipt has not been received within the times set forth in this appendix, conduct an investigation in accordance with item E of this portion of the appendix; and
- (k) Notify the shipper, the department, and the administrator of the nearest commission regional office when any shipment, or part of a shipment, has not arrived within sixty days after receipt of an advance manifest, unless notified by the shipper that the shipment has been canceled.

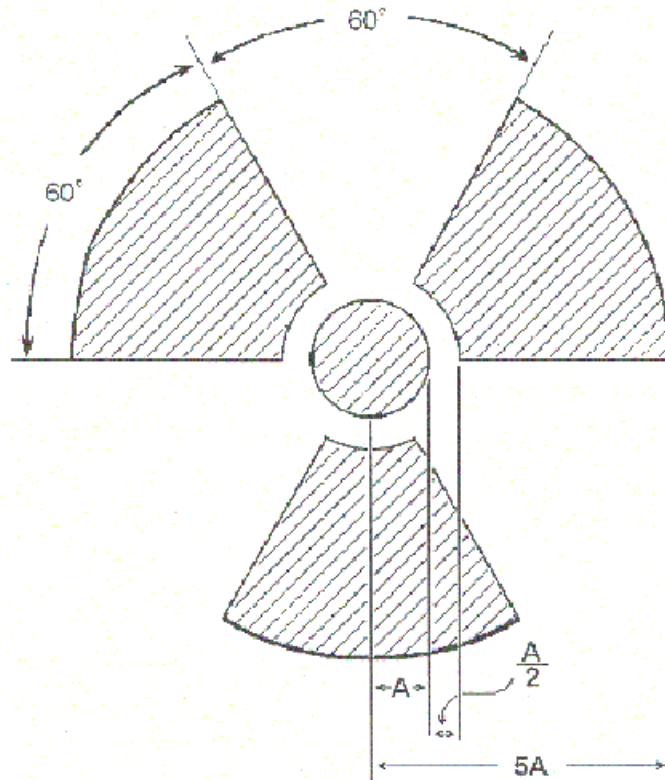
D. The land disposal facility operator shall:

- (a) Acknowledge receipt of the waste within one week of receipt by returning, as a minimum, a signed copy of NRC Form 540 to the shipper. The shipper to be notified is the licensee who last possessed the waste and transferred the waste to the operator. If any discrepancy exists between materials listed on the uniform low-level radioactive waste manifest and materials received, copies or electronic transfer of the affected forms must be returned indicating the discrepancy;
- (b) Maintain copies of all completed manifests and electronically store the information required by 10 CFR 61.80(1) until the department or commission terminates the license; and

- (c) Notify the shipper, the department, and the administrator of the nearest commission regional office when any shipment, or part of a shipment, has not arrived within sixty days after receipt of an advance manifest, unless notified by the shipper that the shipment has been canceled.
- E. Any shipment or part of a shipment for which acknowledgment is not received within the times set forth in this section must:
  - (a) Be investigated by the shipper if the shipper has not received notification or receipt within twenty days after transfer; and
  - (b) Be traced and reported. The investigation shall include tracing the shipment and filing a report with the department and the nearest commission regional office. Each licensee who conducts a trace investigation shall file a written report with the department and the appropriate nuclear regulatory commission regional office within two weeks of completion of the investigation.

## APPENDIX H

### RADIATION SYMBOL



#### A. Color.

1. The cross-hatched area is to be magenta, purple, or black; and
2. The background is to be yellow.

#### B. Dimensions. The dimensions of the symbol are based on the radius of the center circle ( $A$ ):

1. The radius of the symbol is five times the radius of the center circle ( $5A$ ).
2. The space between the center circle and the blades is one-half of the radius of the center circle ( $A/2$ ).